OCTOBER, 1959
Vol. 13, No. 10

FT food technology

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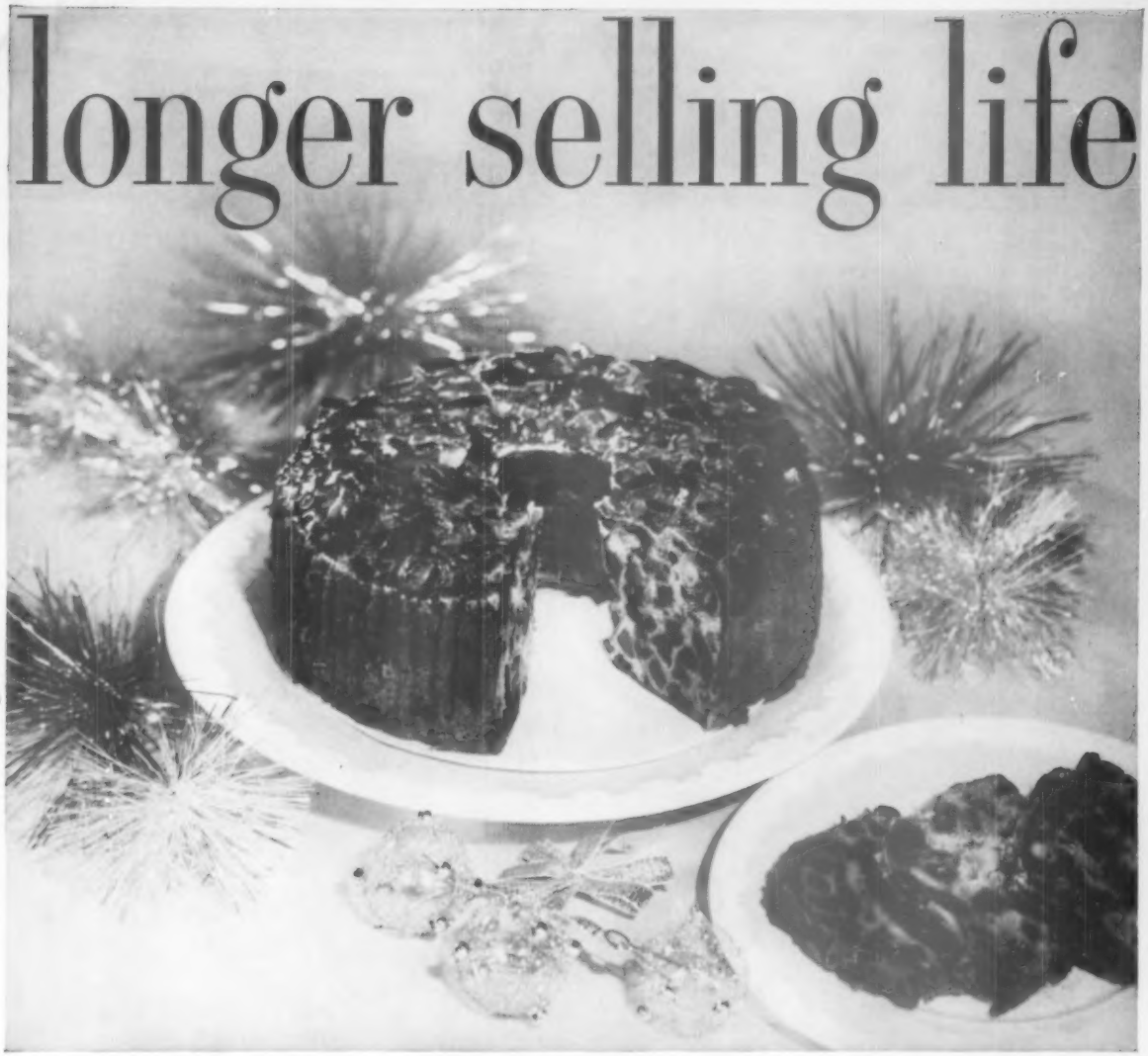

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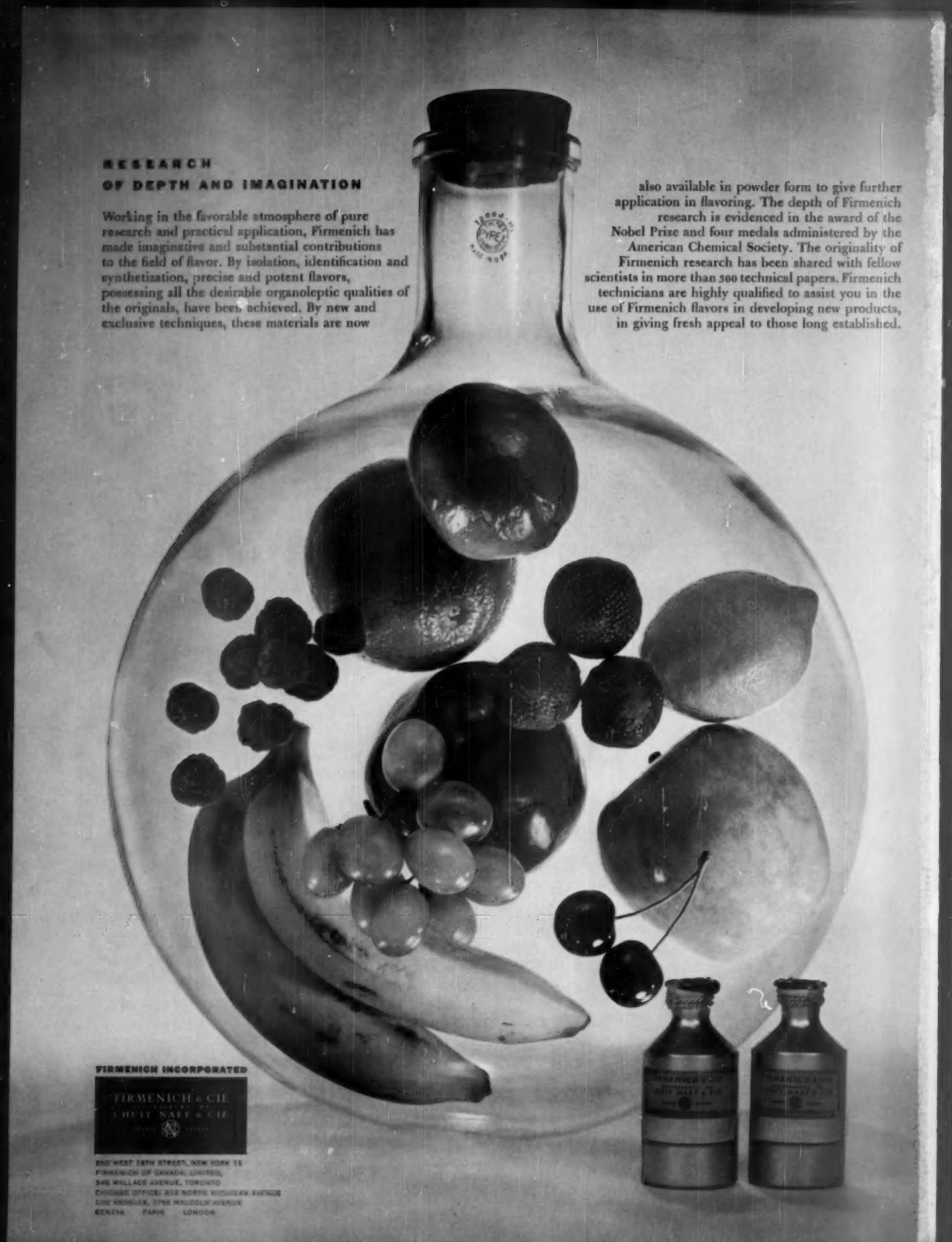
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FT food technology

OCTOBER, 1959
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IN THIS ISSUE—

THE TECHNICAL ARTICLES IN BRIEF

Food legislation *Symposium on definitions and standards*

FOOD STANDARDS SYMPOSIUM. Frank L. Gunderson, moderator. Introduction and background. Frank L. Gunderson. What informed consumers expect from food standards. Mary B. Wood. The pro and con of standards of identity: viewpoints of a professor. K. G. Weckel. An industry view of Federal Definitions and Standards of Identity. Fredus N. Peters, Jr.

The four papers that comprise this symposium cover: the benefits and disadvantages of the Food, Drug, and Cosmetic Act of 1938; consumer, academic, and industry viewpoints as to its usefulness; its effect on research; the results of an informal survey of food industry opinion; a statement, based on the comments elicited by the survey questionnaire, of the general philosophy of the industry; and "some guide posts along the journey to a solution of the problems." The symposium was directed toward problems that have and will continue to have "a very important bearing on the work and potential accomplishments of many food technologists." Areas stressed were (1) the need for accurate, easy-to-understand information on the meaning of standards, (2) the need for re-evaluation of existing standards to correct for changes and new developments, (3) the need for a proper amount of flexibility in order to permit of "change for improvement of quality or value (of foods) or the introduction of new varieties or forms." (See page 541).

Methodology *Aluminum chloride precipitation of pectin*

Preparation of pectin from raw papaya (carica papaya) by aluminium chloride precipitation method. B. S. Bhatia, G. V. Kirshnamurthy and Girdhari Lal.

Since raw materials like citrus peels and apple pomace used in other countries for the preparation of pectin are not available in India in any substantial quantities, indigenous fruits like papaya *(carica papaya)* and jack fruit *(Artocarpus integrifolia)*, widely available in the country, have been tried for the preparation of pectin, using the conventional alcohol precipitation method. In the present paper results of investigations carried on the preparation of pectin from raw papaya by aluminium chloride precipitation method are reported. Preparation of pectin from raw papaya by aluminium-chloride precipitation has shown that concentration of 0.5% aluminium chloride in the cold at a pH of 3.8 to 4.0 gives the maximum yield of pectin. Precipitation at 70° C. lowers the yield of pectin, though the quality of pectin is not much affected. Jelly grade of pectin prepared from peel of raw papaya (18–20% peel in the fruit) is only slightly lower than that from peeled fruit. Peeling is therefore not considered necessary. Yield of pectin prepared from second and third extracts is maximum. Jelly grade of pectin goes on increasing up to three extractions, after which it starts decreasing. Storage of extract without added SO_2 for 4 days at 2–5° C. or with SO_2 for 4 days at room temperature (20–25° C.) does not seem to affect the jelly grade of the pectin. Methoxyl content of the pectins prepared from extracts stored up to 15 days with the addition of SO_2 at room temperature or without SO_2 at 2–5° C. seems to remain unaffected. Most of the soluble solids of papaya mince are leached out by two cold water extractions of 5 minutes each. Loss of pectin in leached water is practically negligible. (See page 553).

Evaluation *Frozen fried chicken*

Effect of pretreatment and type of packaging material on quality of frozen fried chicken. Agnes Frances Carlin, Rose Marie V. Pangborn, O. J. Cotterill, and P. G. Homeyer.

This study was made to determine the effect of several variables on the stability of frozen fried chicken. The influence of the degree of precooking was tested to determine whether or not the flavor of partially precooked frozen broilers was approximately the same as that of a completely cooked frozen product. Three types of packaging material were used, and the flavor of both the meat and the skin was evaluated after storage at 0° F. for 0, 5, 10 and 15 weeks. After 15 weeks of storage at 0° F., untreated broilers were superior to precooked broilers in all palatability factors that were tested. The kind of packaging used did not significantly affect the flavor changes that occurred in untreated or in precooked broilers. Broilers precooked for 3 minutes prior to freezing developed more off-flavor than did broilers precooked for 10 minutes. Flavor changes occurred in the meat as well as in the skin of the precooked broilers. (See page 557).

October Cover: At the beginning of the college year it is fitting to honor the recipients of the fellowship and scholarship awards administered by the Institute of Food Technologists. The names of the keen and personable youths depicted on the cover, the awards they won, and the colleges they attend are:

General Foods Fund Fellowship

Daniel F. Farkas, Massachusetts Institute of Technology
William P. Ferren, Rutgers the State University of New Jersey
Michael R. Gumbmann, University of California at Davis

Gerber IFT Undergraduate Awards

Judith A. Bailey, Oregon State College
Norman E. Bednarcyk, Massachusetts Institute of Technology
William J. Coffin, Iowa State University, Ames
Ronald L. Ellerbeck, University of Illinois
Joel D. Franklin, University of California, Davis
Thomas E. Higgins, University of California, Davis

Samuel Cate Prescott Fellowship

Joan Clark, University of California, Davis

Florasynth Fellowship

Armand J. Desmarais, University of Georgia

Alexander E. Katz Scholarship

Maynard R. Johnson, Massachusetts Institute of Technology

Dodge & Olcott Scholarship

Edward Weiss, Massachusetts Institute of Technology

Educational program expanded for ROCHE BETA CAROTENE

This message concerns the color chart opposite

PLEASE READ THIS PAGE FIRST

The Color that Nourishes in margarine, edible oils, water-based foods explained to consumers

At right is a sample of the large color chart which Roche has published for distribution to thousands of home economics teachers and their students, to dietitians and others interested in nutrition.

This colorful poster is the latest creative effort in the continuing program which Roche is using to educate educators — and through them consumers — in the values of pure, safe beta carotene.

We're telling your present and potential customers that beta carotene *in your foods* is an important ingredient . . . that it is safe . . . that is provides uniform color . . . that is has vital nutritional value because it is provitamin A. **Carotene is the *only* color that nourishes.**

Beta Carotene in your products can be a valuable sales aid. Your foods are more desirable because they are more attractive and more beneficial to health. Beta Carotene can provide the important *plus factor* in your sales story.

Beta Carotene Roche is used in many different foods to give color (ranging from pale yellow to deep orange) and nutritional value. Some of these foods are:

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Shortening • Mellorine • Ice Cream Products
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Fruit Drinks, Fruit Juices and Concentrates
Puddings and Egg Yolk Products • Frozen Foods
Gelatin Desserts • Confections • Dessert Toppings
Popcorn • Cheese • Soups • Creamed Foods

Is your good food on this list? If it is, you will gain from the Roche educational program for beta carotene. If it's not, shouldn't it be? Find out now. Call Roche for expert advice and technical guidance.

A NOTE ABOUT LABELS

You can increase the selling power of your advertising, your sales promotion and your package labels when you actively promote

Beta CAROTENE

as one of your product ingredients. Why? Because it is the only yellow-to-orange color that nourishes.

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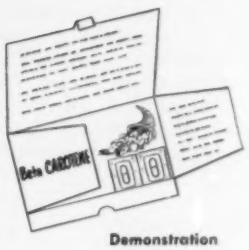

Demonstration Kit

YOURS TO USE

We will gladly supply you with reasonable quantities of the colorful beta carotene chart, the demonstration kit and the educational brochure, "The Story of Nature's Yellow," if you want to use them in your own promotion.

P.S. If you're the one who removes the color chart from this magazine, just put your initials here_____so your associates will know where to look for it. Better still, why not see that all interested people in your organization have a copy of the poster. We'll be glad to send as many as you need.

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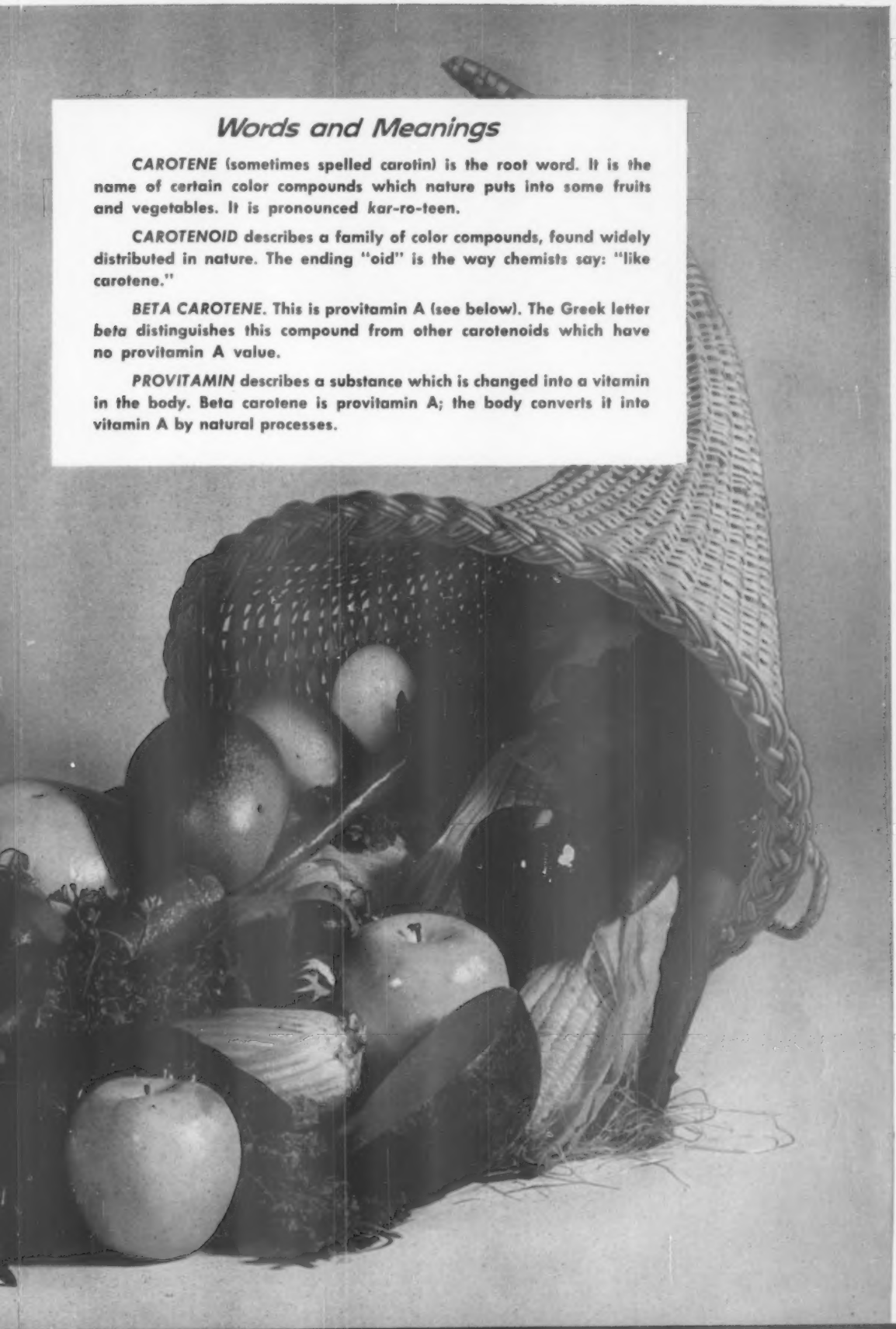
BETA CAROTENE



Words and Meanings

CAROTENE **(sometimes spelled carotin) is the root word. It is the name of certain color compounds which nature puts into some fruits and vegetables. It is pronounced *kar*-ro-teen.**

CAROTENOID **describes a family of color compounds, found widely distributed in nature. The ending "oid" is the way chemists say: "like carotene."**

BETA CAROTENE. **This is provitamin A (see below). The Greek letter *beta* distinguishes this compound from other carotenoids which have no provitamin A value.**

PROVITAMIN **describes a substance which is changed into a vitamin in the body. Beta carotene is provitamin A; the body converts it into vitamin A by natural processes.**

The Safe, Pure Color

Beta carotene, one of nature's own colors, is found in a wide variety of foods which we eat every day.

Man has duplicated nature's beta carotene so that both have exactly the same properties — safety, purity, attractive color, nutritional value. Food processors use beta carotene to give safe, pleasing color and nutritional value to many foods and beverages.

The Safe, Pure Color With Nutritional Value

Because it is provitamin A (see Words & Meanings), beta carotene also provides essential nutritional value. Therefore, for good health, we should eat vegetables and fruits as well as processed foods which contain beta carotene.

Why We Must Have Vitamin A

Vitamin A is necessary to guard the health of our eyes, our skin and other parts of our body. It builds resistance against infections and protects against night blindness. Vitamin A promotes normal growth from infancy to maturity.

Read Your Food Package Labels

Many processors use beta carotene to make their good foods more appetizing, appealing and nutritious. Thus, you will see on food packages: "Colored with beta carotene (provitamin A)." This statement means that these products have been safely colored with nutritious beta carotene.

This educational chart is sponsored by
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CAKE MIX
ORANGE DRINK
Yellow
margarine
Cheese
Yellow
PUDDING

Safe
Sure
Yellow
Pure

The Color That Nourishes

TESTED AND PROVED OK IN ACTUAL INDUSTRY USE

Beta CAROTENE Roche

WITH VITAMIN A POTENCY

Beta Carotene Roche is carotene in the most highly purified form available commercially. It is free of other carotenoids, whose variable color values and lower vitamin A potencies often cause trouble in food processing. Standardize on Beta Carotene Roche for *true carotene yellow color* without any tinge of green or red.

You'll have a better product to make your product better.

NOW 5 CONVENIENT FORMS

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Water-dispersible, free-flowing beadlets to standardize color of water-base foods. Rapidly dispersible with good stability, Roche Dry Beta Carotene Beadlets contribute a clouded effect similar to that produced by fruit insolubles. Excellent for coloring fruit drinks, gelatin desserts, puddings, dessert toppings, mellorine, confections, egg yolk products, baked goods, cheese, creamed foods, etc., with true natural yellow color. Each gram provides approximately 40,000 U.S.P. units of vitamin A as beta carotene.

• 30% BETA CAROTENE IN VEGETABLE OIL

Liquid suspension. 500,000 U.S.P. units of vitamin A activity per gram. Excellent for natural yellow coloring of foods with high fat content: margarine, shortening, lard, baked goods, cake mixes, processed cheese, egg yolk products, candies, soups, stews, frozen dinners, toppings, frostings. Easily handled: liquid at room temperature. Excellent color stability. High purity insures uniformity. Ask for free Roche technical help with all food-coloring problems.

• 24% BETA CAROTENE: SEMI-SOLID SUSPENSION

Contains 400,000 U.S.P. units of vitamin A activity per gram in vegetable oil. Semi-solid suspension facilitates exact weighing for batch control. Used for same foods mentioned above. Roche Beta Carotene imparts to foods a true, *natural* yellow color without "off" shades. Vitamin A value inherently present adds a nutritional bonus.

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Roche will custom blend its Beta Carotene and vitamin A (acetate or palmitate) in vegetable oil exactly to your specifications and package in sealed, sanitary batch-sized cans carrying labels of your formula. This is another example of the extra service margarine manufacturers and processors of other foods can always expect from Roche.

• BETA CAROTENE BLENDS IN VEGETABLE OIL

Blends of Beta Carotene Roche and vegetable oil are available to your specific requirements to a minimum dilution of 6% beta carotene. Your orders are packaged in batch-size, sealed sanitary cans especially labeled for you. Useful for processing baked goods, cake mixes, shortening and lard, cheese, toppings and frostings, candies, soups and stews, frozen dinners. Your foods receive vitamin A value at no extra cost.

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Microscopic investigation *Tomato powders*

Microscopic structure and reconstitution of vacuum-dried tomato powders. R. M. Reeve, Vern F. Kaufman, and Francis F. Wong.

In the production of tomato juice powder, a paste of 25 to 36% solids is aerated, spread about ⅛-inch deep on trays, and dried in a vacuum shelf drier. A vacuum of 1 to 1.5 mm. is drawn and heat is applied to dry the product to 3% or less moisture content. Differences in consistency, however, suggested need for an evaluation of structure in the original juices and pastes as well as in the reconstituted product. Microscopic examinations were made and it was found that rapid reconstitution usually was characteristic of those powders made from original products which contained a high proportion of intact, separated tomato tissue cells. On the other hand, pastes containing tissue particles composed mainly of broken cells and cell wall fragments were found to form vacuum-dried powders which either reconstituted slowly or had inferior consistency. Microscopic investigations included examination of whole, fresh tomatoes as well as determinations of the distributions of the different sorts of tissue particles in both original and reconstituted products. The present paper describes both observations and a simple procedure for evaluating the powders according to powder structure and dispersion in reconstituted juices. Reconstituted juices made from vacuum-dried tomato powders have the same structural characteristics as the pastes used for their manufacture. From 70 to 90% of the suspended tissue particles of some pastes consisted of broken flesh cells and cellulosic wall fragments. The vacuum-dried powders of these were slow to reconstitute and the suspension was often inferior as a juice. A commercial juice, with intact cells comprising about 60% of the suspended tissue particles, produced a vacuum-dried powder of excellent reconstitution qualities; complete dispersion of the powder particles was obtained in 4 minutes. Condition of the pectins in the original paste also influenced powder reconstitution. Enzymatic degradation of the pectins in a paste with a high percentage of intact cells, adversely influenced aeration of the paste prior to drying and resulted in a vacuum-dried powder which constituted poorly to give a granular and watery juice. (See page 561).

Microbiology *Pressure packaged foods*

Microbiological aspects of pressure packaged foods. II. The effect of various gases. G. L. Hays, J. D. Burroughs and R. C. Warner.

Objective of this study was to determine if any commonly used food propellents would inhibit growth of food spoilage organisms. If so, then it might be possible to use less severe processes to render "commercially sterile" foods pressurized with that gas. Nitrogen did not inhibit the growth of any of the test organisms. However, when the oxygen content of headspace gases was reduced before the containers of media were pressurized, growth of *A. niger* was inhibited. *A. niger* was the only organism tested that did not grow in medium gassed with nitrous oxide. When a vacuum was drawn on the cans of media before pressurizing with nitrous oxide, none of the mold cultures grew. Growth of fungi was more effectively inhibited by carbon dioxide than was growth of the bacterial cultures tested. The only fungus to grow in medium charged with carbon dioxide was yeast from beer but this organism did not grow in samples vacuumized before gassing. The oxygen content of samples pressurized with carbon dioxide had no effect upon the growth of the bacteria tested. Carbon dioxide not only inhibited the growth of *A. aerogenes, Cl. botulinum,* P. A. No. 3679, *Cl. butyricum,* and *S. aureus,* but also reduced the number of viable cells or spores. A similar reduction in viable yeast cells also was observed. Using mixtures of nitrous oxide and carbon dioxide, it was observed that the inhibiting concentration of carbon dioxide varies with different organisms. Since none of the commonly used propellents inhibited all test organisms, it was concluded that the thermal treatment necessary to render unrefrigerated pressurized foods "commercially sterile" will be essentially the same as for comparable foods canned in the conventional manner. (See page 567).

Microbiology *Pressure packaged foods*

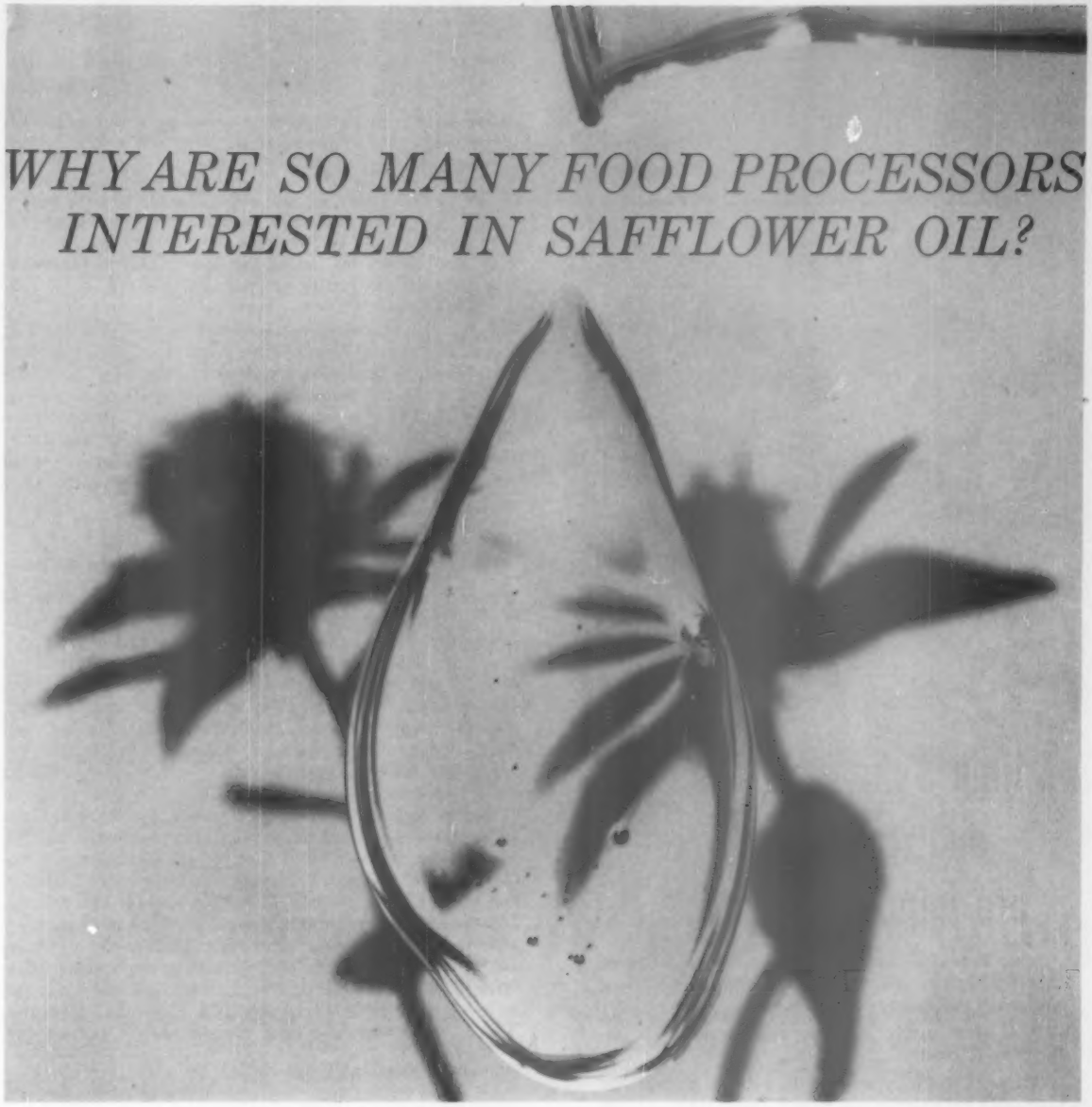
Microbiological aspects of pressure packaged foods. III. The effect of packaging procedures. E. Wheaton and Paul W. Hardy.

The increasing interest in pressurized foods stored at room temperature makes it necessary to focus attention on microbiological problems with respect to prevention of spoilage and assurance of wholesomeness. Results of work reported in this paper indicate that a significantly lower incidence of growth occurs when cans are gassed while the product is still hot, compared to cans gassed after the product has cooled to room temperature. Of particular importance is the fact that it appears possible for the product to become contaminated during gassing if organisms are present in the valve stem. No statistically significant difference in results was shown with the two types of valves employed. In view of the few cases in which mold from the product in the dispensing orifice penetrated into the can, further work on the effect of valve construction and use appears warranted. Although growth of test organisms in some cans may be partly explained by high initial load and the resistant strains employed, results suggest that proper microbiological control in the form of good sanitation should be stressed. (See page 571).

Methodology *Evaluation of cell rupturing*

An improved microscopic method for counting ruptured cells in dehydrated potato products. R. M. Reeve and G. K. Notter.

Investigations were undertaken to establish standard conditions of sample preparation for a more reliable evaluation of cell rupturing in products. An improved rapid method was developed and found to provide good replication for microscopic counts of ruptured cells. Dehydrated samples are diluted directly with hot water (130°–140° F.), and reconstituted or cooked potatoes are diluted with either hot or cold water. An aliquot of the suspension is placed in a counting chamber slide of 1-ml. capacity and a coverglass added. Rupturing as a result of sample preparation is avoided and staining with iodine is unnecessary. Replicate counts of 1,000 or more cells each at 40X magnification showed close agreement. Close agreement between cell rupturing and stickiness in reconstituted products also was obtained. Stickiness increased as cell rupturing increased and was pronounced in samples with 10% or more of the cells ruptured. The method also may be used to determine distributions of separated cells and clusters of unseparated cells in products representing different stages of manufacture. (See page 574).



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Dye reduction test — *Microbiological quality of poultry*

A resazurin reduction test for the determination of microbiological quality of processed poultry. Homer W. Walker, William J. Coffin and John C. Ayres.

In the present study, an attempt was made to show that a correlation exists between numbers of organisms on processed poultry and resazurin reduction time and to show that such a test might find application in determining the bacterial quality of processed poultry. Good correlation was found to exist between time needed to reduce the dye and numbers of organisms/cm.^{2} of skin surface. Variations in total counts of organisms per cm.^{2} of surface and reduction time were attributed to the location on the bird at which the sample was obtained and temperature of incubation. In general, the variations had little influence on the final evaluation of the microbiological quality of the bird. It is suggested that this test could be used routinely for the examination of processed poultry. (See page 578).

Blanching — *Relation to drying rates of peas*

The interaction between blanching and drying rates of peas. J. C. Moyer, H. R. Pallesen and R. S. Shallenberger. Blanching, that is, the preliminary heat treatment of raw products, has been found to assist in the retention of quality and nutritive value of the dehydrated product. Blanching may be carried out in either hot water, flowing steam or steam under pressure. Steam blanching has been found to give higher yields of dehydrated vegetables, better flavor retention and resistance to browning during high temperature storage. Blanching has also been reported to promote faster dehydration, but there is little information on the extent to which drying may be accelerated by the degree of preliminary heat treatment. In the present study, peas of varying maturity were blanched for various times in water at 210° F. and for two minutes in steam under pressures ranging from 0 to 16 pounds per square inch. Peas of the Perfected Freezer variety ranging in maturity from 7.6 to 18.3% alcohol insoluble solids were blanched in water at 210° F. for 1, 2, 4 and 8 minutes or for 2 minutes in steam at 0. 2, 4, 8 and p.s.i. pressure. The moisture loss from each sample was determined during dehydration and related as $\sqrt{\frac{1}{\text{lbs. } H_2O/\text{lb. dry wt.}}}$ to drying time. The slope of the line of best fit was measured as angle Θ which as a single value represented the drying rate of the sample. An analysis of variance between maturity of the raw peas, blanching treatment and drying rate showed that maturity is a governing factor with the drying rate decreasing as the peas become older. This maturity effect can be overcome in part by increasing the severity of the blanching treatment. Steam under pressure appears to offer greater possibilities than other methods for reduction of drying time by variations in blanching conditions. (See page 581).

Dye reduction test — *Shelf life of poultry meats*

Resazurin reduction tests for shelf life estimations of poultry meats. F. E. Wells.

There is need for determining bacteriological condition of poultry meats in order to be able to predict shelf life and

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indicate the sanitary conditions under which such meats are processed. Some attempts have been made to apply dye reduction tests to determine the state of poultry meats and poultry products. This study was made to determine the relationship of resazurin reduction to population estimations on poultry and to evaluate a device for sampling a defined area of surface. Reduction tests using both swab and wash sampling methods and resazurin dye as the indicator were studied. A device for sampling a given area of surface by washing the desired area with a sterile nutrient solution is described. The sampling device was found to be more efficient than the swab in estimating numbers of bacteria from a given area. Tests showed that with the wash sampler a reduction time of two hours or less may be expected at the near spoilage stage. The possibilities of using this test to estimate shelf-life of poultry meat are discussed. (See page 584).

Pesticidal treatment *Effect on flavor*

Effects of certain pesticides on flavor of frozen strawberries. D. A. Tichenor, J. G. Rodriguez, and C. E. Chaplin.

This paper describes two years' flavor evaluation tests with frozen strawberries from plants sprayed with each of 21 insecticides and five fungicides. Included are methods of growing and processing the fruits, and methods and results of taste tests conducted in 1957 and 1958. In addition to flavor evaluations on the frozen fruit, the experiment included studies of the biology of mites and insects attacking strawberries and the effectiveness of acaricides and insecticides in controlling these pests. Chemical residue analyses on the frozen strawberries were made by a USDA research laboratory. Because fungus diseases and rots may also injure strawberries during wet years particularly, a fungicide, captan, was added to all spray materials except aramite. Captan and four other fungicides were studied separately in 1958. Under the conditions of this experiment, none of the pesticides tested imparted detectable off-flavors to frozen strawberries, even to fruit harvested one day after spraying. In 1957, a significant number of judges were able to distinguish differences between samples treated with tedion, parathion, thimet, malathion, and guthion; but these differences were not considered to be off-flavors. In two instances where differences were observed, strawberries from plots sprayed with malathion and with guthion, harvested one day after spraying, were judged to be significantly better than the controls. Apparently these pesticidal treatments had some slight temporary flavor effect which the judges found desirable. In 1958 tests, significant differences between treated and untreated strawberry samples were observed in those treated with TDE and with mitox. Again, the differences were apparently not off-flavors because the treated samples received flavor rating scores which were about the same as those of their controls. None of the five fungicide-treated samples tested was judged to be significantly different from the controls. (See page 587).

Product Standards for Iran:

Bureau of Standards Projects, Training Requirements, and Regional Coordination*

T. L. Swenson, Ph.D.

Chief Advisor, Bureau of Standards, United States Operation Mission to Iran, International Cooperation Administration, Tehran, Iran

THERE ARE MANY PROBLEMS confronting the introduction and adoption of product standards in the Middle East. One of the fundamental difficulties confronting me, as well as many of my American colleagues, is the language barrier. This, coupled with the unfortunate handicap of illiteracy, on the part of many of the people, multiplies the difficulties. The problem is, I might emphasize, *illiteracy* and not *native ability*—which is high.

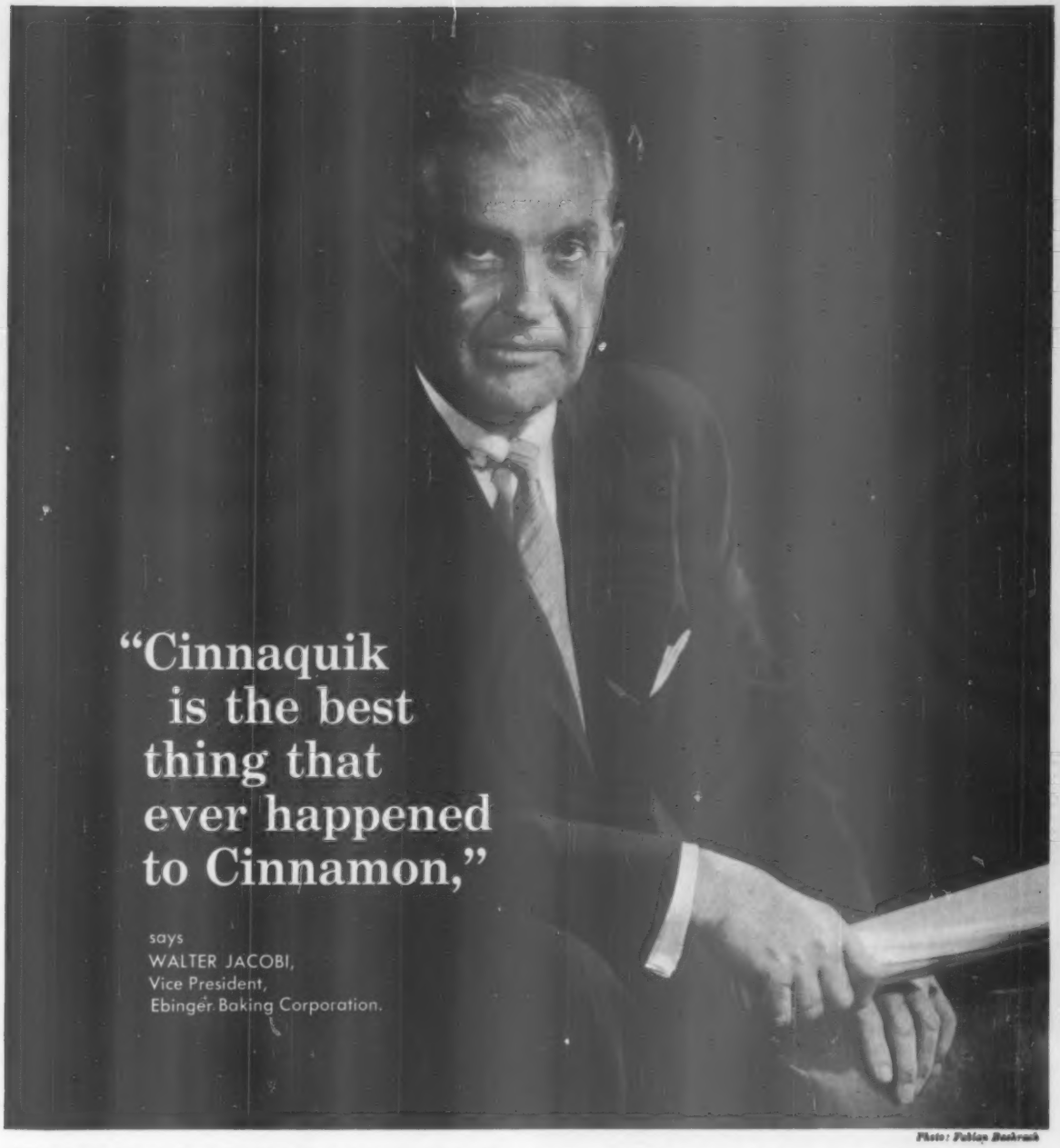
The basic problem begins with *where* and *how*, intelligently and effectively, to begin to help correct this lack of education and/or illiteracy? Exposure to all the education in the world will do no good for those not prepared or equipped to accept it. In spite of the urgent need for enlightenment, learning cannot be passed out like so many pieces of candy.

"HASTE IS MADE SLOWLY"

In the introduction of a standards program of such basic importance to the economy of the Middle East, and Iran in particular, "haste is made slowly." No one can be expected to accept and use that which they do not understand. I am sure you will all agree training is one of the very important aspects of our job.

Secondly, consideration must be given to the medium through which the trained technicians can

* Presented at the Intraregional Congress De Normalisation Au Moyen-Orient, Beirut, Lebanon, May 7, 1958.



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reach the business people, processors, brokers or exporters to make them aware of the basic objectives of the project and its potential value to them, as individuals, or to the national economy of Iran. Our approach to this problem is the encouragement of the organization of trade and/or market or export associations. Groups, such as these, furnish practical working liaisons.

A serious handicap encountered in undertaking a project of this kind is the limited number of trained technicians available for staffing such projects. Dr. Khorsand [b] and I have been spending considerable time planning and developing a practical training program to fill our required complement of technical personnel.

Dr. T. L. Swenson, Chief Project Adviser, Bureau of Standards and Dr. Majid Khorsand, Director, Bureau of Standards, inspecting test equipment furnished project by I.C.A.

One of our first responsibilities is to "train our trainers." This must be done if we are ever to assemble a staff of competent, qualified "trainers" capable of passing along to others an intelligent understanding of standards and their beneficial application to commerce. We are gradually overcoming this problem through the medium of special training for some of our college-trained personnel; namely, sending them abroad on "training grants." Under this project, six Iranian students have been sent to the United States for periods ranging from six months to two years. They are sent to selected universities and/or laboratories or processing plants or all three. Six have returned to Tehran and all are presently engaged in the preparation of commercial statistical data pertinent to their respective fields of specializations, both as it relates to the commerce of Iran and the commerce of the Middle Eastern Area as a whole.

At the present time there is one trainee in the U.S.A., and provision has been made to send two

[b] Dr. Majid Khorsand, Director, Bureau of Standards, Iran.

His Excellency, Dr. Mehran, Minister of Education (center) discusses field training assistance with agricultural college supervisors in I.C.A. sponsored food processing laboratory.

others during the present fiscal year. In addition to this, at my request, the Ministry of Commerce is arranging to bring in two additional foreign advisers to work with me. Certainly this is not a one-man job.

A BASIC PREMISE

Before going further permit me to present a basic premise, which is, I believe, common to all standards projects:

The selection of instruments, their adjustment and the maintenance of adjustment must be matched by the ability of the operator to read the indicated values if reliable data are to be obtained. The trainee must understand the significance of each of these items before he may know the accuracy of his work and the effectiveness of his attempts at standardization. The only way in which this can ever be realized is through careful training. Unless there is a clear understanding and interpretation of results, as they apply to a given standard, the success of the program is doomed to failure.

Iran, at the present time, has no accepted quality or performance trade standards for any of its domestic or export commodities. Therefore, as a means for "improving the quality and grade of exports (so that they may find responsive markets both in the United States and other countries), the government of Iran is co-sponsoring, with USOM/Iran, the Introduction and Regulation of trade standards.

Rather than attempting to spend time and money on research formulating or developing new standards I have recommended that only those commodity stand-

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ards, presently acceptable in world channels of trade, be considered for adoption and adaptation to Iranian commodities. Initial emphasis will be devoted entirely to export items.

The Government of Iran has contributed rials 20,000,000 (present rate of exchange rials 76 per $1) for buildings to house the project staff, laboratory equipment, and supplies. The United States government has spent approximately $400,000 in "off-shore" purchases for laboratory equipment and supplies. Most of these purchases have been received and we are just starting to equip the laboratories for work.

THE PROGRAM

The program, envisioned for the Iranian Bureau of Standards (recently proposed to be changed to the "Iranian Technical Institute of Standards") is exceedingly broad in scope and varied in its economic interests. Its interests embrace activities of technological, scientific and public-relations character and/or combinations of all three. As a matter-of-fact the scope is so broad in its concept as to be almost incomprehensible at first glance. The latitude and scope of activities makes it advisable to consider, at the outset, the design and inauguration of a "uniform project system" which will provide: first, competent, practical means for work direction; and second, information relative to the efficient pursuit of all lines of active endeavor. Such a system provides an efficient, analytical basis for work administration as well as a sound basis for budget estimates.

The highly diversified character of Iranian exports necessarily demands that quality control and packaging of all Iranian agricultural export commodities be given primary consideration. Checking Iranian food and therapeutic imports for purity must also be considered insofar as conformance to import standards is concerned. Sampling and checking, to determine conformance to standards of quality, and performance, on all imports of manufacturer's goods and construction supplies, will in due time receive attention. Eventually quality and specification standards should be established to develop and enforce a "manufacturer's code" in cooperation with manufacturers.

This code should serve to increase the acceptance of domestically manufactured products by the public through the maintenance of high manufacturers' standards. To accomplish this manufacturers should be free, at all times, to call upon all agencies providing technical assistance for suggestions and guidance in the development of codes for standards as well as assisting, wherever possible, in the improvement of manufacturing techniques.

A suggested means for the fulfillment of this basic need is presented in graph form in the "project planning outline" which will serve as a guide or format for drafting broad "key commodity projects" as well as for drafting the short-term, finite "unit line projects." These are essential for the completion of the over-all project, for purposes of budgeting "man-hours," and for the estimation of funds necessary for operation.

Still another problem relates to the integrity of the "inspection service unit." This should at all times be unimpeachable in its scope. Administratively the integrity of the unit, as an unimpeachable source, must be maintained at all costs.

A "whole-area" point of view.

In suggesting a framework for a broad gauged, centralized standards program, the writer is conscious that a "state-side" type of program, designed for national quality-control, would be too complicated and impractical for most under-developed countries; it should be offered first as a simplified program introducing only standards of minimum quality-grades; only "A" and "B" quality being acceptable for export, the balance of goods remaining for either domestic consumption or processing. That the development or considerable expansion of export industries in these countries should not injure the market of competing countries; that, therefore, in activating, a dried fruit export program for Iran, for example, its effect on the dried fruit markets of other ICA-assisted countries should be considered. Since there are many exports of the Middle East and Mediterranean countries, common to them all, it is the writer's considered opinion that it should be both possible and quite practical to think in terms of the whole area into

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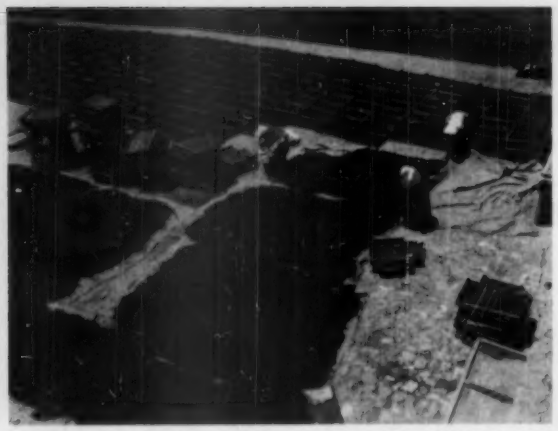

Re-drying cleaned raisins in packers yard at Ghazvin, 100 miles west of Tehran.

which the program of any individual country can be coordinated.

In other words, in spheres of common interest, continuing coordination, at the work level, between all member countries would: simplify the work and, insofar as the introduction of standards is concerned, the end result would be one of simultaneous uniformity throughout the entire area. Thus, projects of different ICA/Missions, having the same basic objectives, would be coordinated into a closely knit intra-regional program whose basic objectives would be pursued simultaneously. The end results of such practical planning should be obvious.

Possibilities of economic and industrial development in this Middle Eastern area, by adoption and regulation of uniform, internationally accepted "trade standards," should do more than merely capture the imagination. Such potentialities should stimulate positive action.

Agricultural college supervisors in workshop training at Tehran food processing laboratory.

Up to the present time little effort has been made to bring individual technicians together at the work-level for the exchange of ideas at regular intervals, whose projects or fields of endeavor possess common basic objectives.

The desirability of establishing continued coordination of effort and exchange of ideas between ICA missions should offer a personal challenge to each project leader and/or technician, to make an intelligent analysis of all the problems of common interest. The free exchange of ideas between technicians of various ICA missions, at regular intervals, would do much to stimulate potential economic development as the result of adoption and regulation of uniform trade standards. It is important that we do not lose the limited progress already made by permitting good individual efforts to dissipate because of lack of coordination.

The idea of introducing uniform trade standards is relatively new to the various countries of the Middle East. That neither the packer nor the exporter can arbitrarily set standards, which determine the market value of any given commodity, is not clearly appreciated or understood.

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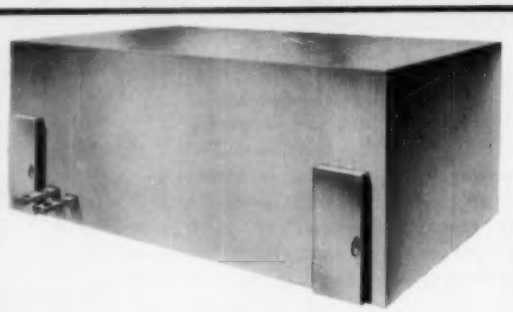

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Teaching people to accept and practice grading products of commerce to standards presents an enormous educational task, made even more difficult and complicated because of illiteracy. In their ignorance of fundamental concepts of good practice in the fields of market grades and standards they are inclined to resist new ideas and change, to the utmost. Thus, it is apparent that solutions to these problems must be approached with the thought that there are established criteria and existing precedents. What we have is an unmeasured supply of facilities and abilities from which to shape something new.

It is obvious that we cannot undertake solving every economic problem complicating regional coordination and development. Collectively and regionally, we will, in time, have accumulated a foundation of information and ideas on which future adoption of uniform trade standards can be established permanently throughout the entire area.

By taking a broad perspective and looking at all the problems, their interrelationships become discernible. We can, I am quite confident, discover clues for the solution of mutual problems whose basic objectives are common to all. I have a philosophy relative to our respective missions or assignments to these various host countries in which we work. It is quite clearly expressed in the following old Chinese proverb:

"If you plant for a year—Plant grain.
If you plant for 10 years—Plant trees.
If you plant for 100 years—Plant men."

If, however, we are to realize any fruits from our labors, we must first "Plant ideas."

My one sincere hope is that those ideas which I have sought to plant will bear fruit in time. "Inshallah."*

* A common arabic expression meaning "God willing."

CANADA DEPARTMENT OF AGRICULTURE RESEARCH SERVICES NOW CONSOLIDATED

All the research services formerly in the Canada Department of Agriculture were reorganized on April 1st, 1959, into one group now called the Research Branch, Canada Department of Agriculture, with its own Deputy Minister, Director General, etc., and headquarters at Ottawa. Several institutes have been formed at Ottawa to conduct investigations into the more fundamental and longer term national problems. The field units will continue very much as before, except where there were larger groups of many scientific disciplines. In these instances they have been combined under one Director as a regional Research Station. The purpose of the reorganization in the research facilities of the Canada Department of Agriculture, was to simplify administration and increase the efficiency of research investigation.

Of Professional Interest

Nominations Now Open for Food Technology Industrial Achievement Award

The Institute of Food Technologists, Donor, announces the opening of nominations for the second FOOD TECHNOLOGY ACHIEVEMENT AWARD. The award consists of the following: To the Company or Institute, a bronze plaque. To the individual(s) judged to have made major contributions to the achievement, either through basic research or development, public recognition at the time of presentation of the Award, and an engrossed plaque.

The purpose of this award is to recognize and honor an outstanding food process and/or product, which represents a significant advance in the application of Food Technology to food production, and which has been successfully applied in actual commercial operation at least six months but not over four years prior to the date of calling for nominations. Insofar as possible, this Award shall be personalized by public recognition of the individual(s) responsible for the achievement.

CALL FOR NOMINATIONS

Any member of the Institute of Food Technologists may make nominations for the Award. Each nomination must be in letter form and include the following:

Name of Company or Institution.
Name of Product and/or Process.
Description of Product or Process.
Statement of reason for considering this a meritorious achievement.
Statement listing individuals chiefly responsible for the achievement and their individual contributions.
Statement indicating the time and extent of commercial utilization.

Nominations must not exceed three, single-spaced, typewritten pages. December 1st is the deadline for receiving nominations. Send nominations to the Secretary, Institute of Food Technologists, 176 West Adams Street, Chicago 3, Illinois.

AWARDS

The Babcock-Hart Award

DONOR: The Nutrition Foundation, Inc.

AWARD: $1,000.00 and an engrossed plaque.

PURPOSE: To honor a person who has distinguished himself or herself by contributions to Food Technology which have resulted in improved public health through some aspect of nutrition or more nutritious food.

NOMINATIONS: Nominations may be made by any member of the Institute of Food Technologists. Nominations shall be in letter form giving a biographical sketch of the nominee and detailing the contributions that would qualify the individual for the award. Nominating letters shall be limited to two, single-spaced, typewritten sheets. This Award can be made only for technological developments or scientific contributions which lead directly to technological developments. January 1st is the deadline for receiving nominations. Address letter to the Secretary, Institute of Food Technologists, 176 W. Adams St., Chicago 3, Illinois.

The Nicholas Appert Award

DONOR: The Institute of Food Technologists.

AWARD: This Award, originated by the Chicago Section of the Institute of Food Technologists, consists of a Bronze Medal (furnished by the Chicago Section) and an honorarium of $1,000.00.

PURPOSE: To honor a person for pre-eminence in and contributions to the field of Food Technology.

NOMINATIONS: Nominations may be made to the Executive Secretary by any member of the Institute of Food Technologists. Nominations shall be in letter form giving a biographical sketch of the nominee and detailing the contributions that would qualify the individual for the award. Nominating letters shall be limited to two, single-spaced, typewritten sheets. January 1st is the deadline for receiving nominations. Address letter to the Secretary, Institute of Food Technologists, 176 W. Adams St., Chicago 3, Illinois.

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DPi

leaders in research and production of vitamin A

Distillation Products Industries

is a division of **Eastman Kodak Company**

Directory of IFT Committees—1959-1960*

THE USEFULNESS of this directory of IFT Committees needs no elaboration. These are the Committees and these are the able and "Institute-spirited" people who man them. Their over-all commitment is to study and resolve the major problems that confront a professional society like IFT. Broadly speaking, a professional society has responsibilities with respect to: the administration of its business affairs; the professional status of its members; the quality of the scientific or technological product of their efforts; professional training; recognition of achievement; and, of great importance, responsibilities with regard to relations with the public and with the scientific community. It will be evident in this directory that all of these areas, and more besides, are served by the various IFT Committees herein listed.

Contents

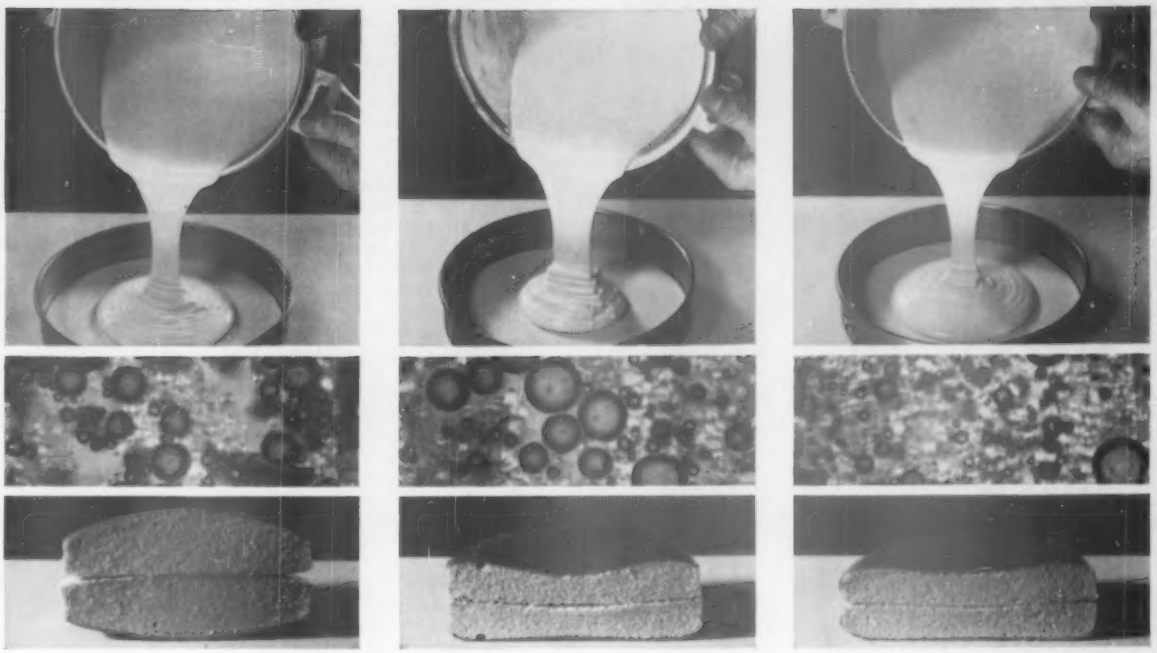
EXECUTIVE COMMITTEE OF THE COUNCIL
Mr. Ray Wakefield, Chairman

STANDING COMMITTEES
Committee on Awards
Mr. Alan Richardson, Chairman
Committee on Civil Defense
Dr. Richard Forsythe, Chairman
Committee on Constitution and By-Laws
Dr. Byron Shinn, Chairman
Committee on Education
Dr. Robert Schaffner, Chairman
Committee on Exhibits—Annual Meeting 1960
Mr. Hugh Griswold, Chairman
Committee on Finance
Dr. Arthur Prater, Chairman
Committee on History
Dr. Zoltan Kertesz
Committee on Membership
Mr. Charles Flynn, Chairman
Committee on Nominations
Mr. B. Grossi, Chairman
Program Advisory Committee
Dr. Bernard Proctor, Chairman
Program Committee—Annual Meeting 1960
Dr. George Stewart, Chairman
Committee on Publications
Dr. Howard Spencer, Chairman
Committee on Qualifications
Dr. George Brissey, Chairman
Committee on Resolutions
Dr. Harold Schultz, Chairman

TECHNICAL COMMITTEES
Committee on Citrus Products
Mr. Charles Brokaw, Chairman
Committee on Food Additives
Dr. John Mahoney, Chairman
Committee on Taste Testing
Dr. H. L. Stier, Chairman

* Names of the Committees, their respective objectives, names of chairmen and members are provided. Space limitations prevent the inclusion of addresses except in special instances where the addresses have particular usefulness. Where addresses are not furnished, the reader is referred to the Institute of Food Technologists' *Directory of Members, 1959.*

Cake drama in three acts, starring the emulsifier



I

Curtain raiser Here is a rather thick but pourable batter with a very slight curdle. Below it, a peek into the live batter, one hundred times actual size, reveals a wide distribution of air bubble sizes. Not all the fat has been used up in making bubble walls. Darker areas of reserve fat are seen by the naked eye as curdle. Then, as the relatively weak-walled bubbles gently break during baking, the fat assumes its second role of coating the gluten-and-starch framework. First-act climax: a good cake. Excellent volume, fine and even grain, thin cell walls, whiteness.

II

Plot thickens It's the same formula otherwise, but emulsifiers have been chosen to make a very smooth, very thick batter. In the photomicrograph you see why there's no curdle: all the fat has been used in making big, thick bubble walls. You also see why the batter is so viscous: the big bubbles get in each other's way. Here, alas, the emulsifier builds *too much* strength into the bubble walls. Suspense. By the time the bubbles finally do break, considerable gas pressure has built up. The sudden release of energy shatters the still tender skeletal structure. Tragedy!

III

Anticlimax Now we have swung off to another extreme, using in the same formula emulsifiers that produce a very smooth and very thin batter. Note the small, uniform bubbles floating in a sea of liquid. (There's your low viscosity.) Note the fat all used up in making the bubbles strong. (No curdle.) Finale: in the oven, sudden energy release produces the same collapse as in Act II, with thick cell walls and open grain.

Program note: The offstage voice advancing hypotheses about bubble strength is that of one batter theoretician among many. He has never been inside a cake in the oven.

EPILOGUE: Texture, both of the batter and of the cake, depends on the emulsifier. With *Myverol® Distilled Monoglycerides*, the texture is subject to practical engineering control, regardless of the fine points of underlying theory. Such control is both possible and economical because we, in our own production, have the precise control that comes from segregating fats as vapors. Interested in what we can do for you with this unique power? For particulars, write ***Distillation Products Industries,*** Rochester 3, N. Y. Sales offices: New York and Chicago • W. M. Gillies, Inc., West Coast • Charles Albert Smith Limited, Montreal and Toronto.

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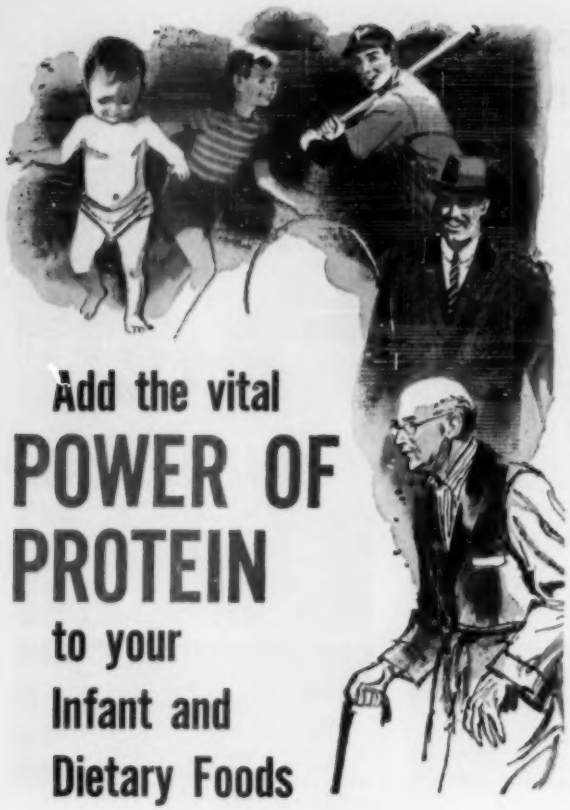

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Braun Chemical Company — Los Angeles, San Diego, Phoenix, Albuquerque, El Paso

AD HOC COMMITTEES

Ad Hoc Committee on High School Career Day Activities
Dr. Gale Ammerman, Chairman
Ad Hoc Committee on International Congress on Food Technology
Dr. Emil Mrak, Chairman
Ad Hoc Committee on Publications (sub-committee)
Dr. Howard Spencer, Chairman
Ad Hoc Committee on Regional Boundaries
Dorothy Ann Huber, Chairman
Ad Hoc Committee to Study Administrative Policy
Dr. George Garnatz, Chairman
Ad Hoc Committee to Study the Desirability of Making Grants from the Institute Treasury to Small Regional Sections
Dr. Imri Hutchings, Chairman
Ad Hoc Committee to Study IFT Journals
Dr. Imri Hutchings, Chairman
Ad Hoc Committee to Study and Recommend a Public Relations Program for the Institute of Food Technologists
Mr. Loren Sjöström, Chairman
Ad Hoc Committee to Study Ways and Means of Advancing the Science of Food Technology
Dr. Imri Hutchings, Chairman

LIAISON REPRESENTATIVES

Liaison Representative to the Agricultural Research Institute of the National Research Council
Dr. Ira Somers
IFT Representative to the Council of American Association for the Advancement of Science
Dr. Charles Frey
Liaison Representative to the Food & Nutrition Board of the National Research Council
Dr. Bernard Proctor
Liaison Representative to the Food Protection Committee of the National Research Council
Dr. John Mahoney
Liaison Representative to the U. S. National Committee for the International Institute of Refrigeration
Dr. H. C. Diehl

Executive Committee of the Council

The responsibility of this Committee is to exercise for and on behalf of the Council all of the functions the Council may authorize by resolution. See Article VII, Section 7 of the Constitution; Article XVI, Section 2, (a); Article XX, Section 2; Article V, Sections 1 and 2; Article VII, Sections 1 and 2; Article X, Sections 1 and 2; Appendix to the By-Laws, and Article IX, Sections 1, 2 and 6 of the By-Laws.

Membership:

President
Mr. Ray Wakefield
Gerber Products Company
445 State Street
Fremont, Michigan

Past President
Dr. Aksel Olsen
101 Crestwood Lane
Harbor Bluffs
Largo, Florida

President Elect
Dr. Imri Hutchings
H. J. Heinz Company
P. O. Box 57
Pittsburgh, Pa.

Treasurer
Dr. Arthur Prater
Gentry, Inc.
2076 Terminal Annex
Los Angeles, California

1959–1960

Dr. George Garnatz
The Kroger Foundation
2565 Fleetwood Avenue
Cincinnati 11, Ohio

Dr. Philip Bates
Carnation Company
363-17th St.
Santa Monica, California

Dr. Clarence Wiesman
Armour and Company
Union Stock Yards
Chicago, Illinois

Dr. Edward Burns
Texas A & M College
College Station, Texas

Mr. Leslie Rutledge
Stokely-Van Camp, Inc.
Indianapolis, Indiana

Dr. Oscar Skovholt
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Committee on Awards

This committee is responsible for the administration of the Awards program of the Institute in accordance with the policies, rules and regulations governing awards as amended to August 1958.

Revisions to these rules and regulations may be made during the current year. The chairman will be appraised of any changes as soon as they are made by the president of the Institute.

Mr. Alan Richardson, Chairman, California Packing Company, 215 Fremont Street, San Francisco, California
Dr. Horace Sipple, Vice Chairman, The Nutrition Foundation, 99 Park Avenue, New York 16, New York
Nicholas Appert Award Jury: Dr. George Beach, Chairman, Libby, McNeill & Libby, Blue Island, Illinois
Babcock-Hart Award Jury: Dr. Aksel Olsen, Chairman, 101 Crestwood Lane, Harbor Bluffs, Largo, Florida
Food Technology Achievement Award Jury: Dr. Berton Clark, Chairman, 413 Division Avenue, Oak Park, Illinois
International Award Jury: Dr. Emil Mrak, Chairman, University of California, Davis, California
Graduate Awards Jury: Dr. Margaret Ives, Chairman, American Can Company, Barrington, Illinois
Undergraduate Awards Jury: Dr. A. N. Stuart, Chairman, Wm. Underwood Company, One Red Devil Lane, Watertown 72, Massachusetts

Committee on Civil Defense

The primary objective of this committee is to create an awareness in the members of the Institute of Food Technologists of the problems that could be faced by the food industry in case of a national emergency.

To prepare, with the assistance of all available governmental agencies and documents, an educational "file" to be available for IFT members in addressing local sections or other similar meetings. To encourage local sections to include in their program at least once during the year a discussion of the Civil Defense of the Food Industry. To formulate plans for nationwide complete coding of food packages for the purpose of being able to identify contaminated food products in the case of an emergency.

Dr. Richard H. Forsythe, Chairman, Henningsen, Inc., Box 2327, National Station, Springfield, Missouri

Dr. Robert Baldwin	Dr. Frank Gunderson
Dr. Franklin Barber	Mr. John Kilbuck
Dr. Howard Bauman	Dr. Emil Mrak
Dr. Rudolph Ellinger	Dr. Roy Newton
Mr. William Ferracone	Mr. George Putnam

Dr. Keith Lewis

Committee on Constitution and By-Laws

General Objectives:

1. The committee shall receive proposals for amendments to the Constitution. These it shall study and make recommendations thereon for submission to the Executive Committee of the Council.
2. Where, in the judgment of the committee, changes in the Constitution are indicated, the committee may seek formal recognition of the need by submitting a proposal for the required number of signatures to permit formal action to be taken.
3. The committee shall on request of the Council, or the Executive Committee of the Council, offer interpretations of the Constitution or of the By-Laws.
4. The committee should be advised of needed changes or proposed changes (including additions) in the By-Laws, so that such changes may receive proper study to avoid possible conflicts with other sections of the By-Laws or with the Constitution.
5. Where the Council amends the By-Laws without previous consultation with our committee, a copy should immediately be sent to our committee for review.

Specific Assignments:

The committee will study the following sections of the Constitution and, if possible, make a report to the mid-year meeting of the Executive Committee.

Constitution:

1. Article VI—Section 4
2. Article VII—Section 2
3. Article X
4. Article XVI
5. Article XX

By-Laws:

It should be noted that Article IV—Section 1; Article V—Section 3. b. and Article IX—Section 4 were changed by action of the Council at Philadelphia and should be so printed in the revised By-Laws. The following needs further study:

Article V—Section 1

Membership:

Dr. Byron Shinn, Chairman, Armour and Company, Union Stock Yards, Chicago, Illinois

Dr. LaVerne Clifcorn	Mr. Carl Pratt
Mr. Hugh Griswold	Dr. Marcus Wegner

Committee on Education

This committee has proposed a model curriculum and is currently surveying industry to determine its needs for Food Technologists. During this coming year, the committee will attempt to accomplish the following objectives:

1. Complete survey and make arrangements for its dissemination.
2. Review the proposed model curriculum to determine if any modifications are in order, and to discuss them at a joint industry-academic conference if one is held in the spring of 1960.
3. Investigate the organizational plans for Food Technology within our Universities and Colleges offering Food Technology and possibly make plans to discuss related problems at the proposed conference.
4. Make recommendations to the Executive Committee and Council of the Institute regarding the steps that should be taken to expedite the adoption of the model curriculum by our educational institutions.
5. Make recommendations regarding action that should be taken by the Institute in order to interest more students to enroll in Food Technology, Food Science and Food Engineering, possibly through the revision and publication of the Food Technology professional career brochure.

Membership:

Dr. Robert M. Schaffner, Chairman, Libby, McNeill & Libby, 200 South Michigan Avenue, Chicago 4, Illinois

Dr. LaVerne Clifcorn	Dr. Harold Rich
Mr. John Heinen	Dr. William Shannon
Mr. Varnum Ludington	Dr. George Stewart
Mr. Howard Milleville	Dr. A. N. Stuart
Dr. Reid Milner	Mr. Charles Townsend

Dr. Kenneth Weckel

Committee on Exhibits

The purpose of this committee is to assist the Executive Secretary in the handling of exhibits at the 1960 Annual meeting in San Francisco. Activities of the committee will be directed by the Executive Secretary.

Mr. Hugh Griswold, Chairman, Owens Illinois Glass Company, 500 Sansome Street, San Francisco, California

Mr. F. Leslie Hart	Mr. Gordon Miller
Mr. R. J. McGrath	Mr. E. L. Mitchell

Committee on Finance

This committee has the general responsibility of initiating policy in respect to the handling of Institute finances, of approving the annual budget, and of discharging such other duties in connection with the business affairs of the Institute

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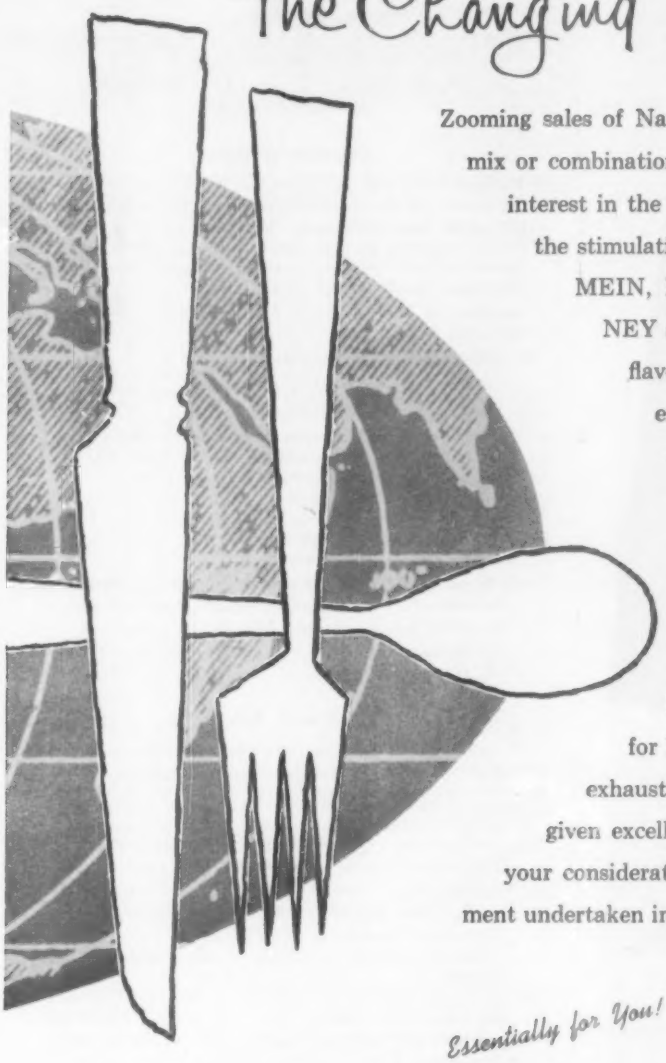

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as may be assigned to it by the Treasurer. By-Laws, Article VI, Sections 1 and 2 and Article IX, Section 3.

In addition, the following assignment has been given this committee: "As soon as possible, but at the latest by the December meeting of the Executive Committee, prepare recommendations for a procedure to handle funds to be used for the purpose of advancing the Science of Food Technology. This to provide a receptacle to receive surplus funds of the Institute, plus any donated funds from outside sources."

Membership:

Dr. Arthur Prater, Chairman, Gentry, Inc., 2076 Terminal Annex, Los Angeles, California

Mr. Ray Junk, Vice Chairman, C & H Sugar Ref. Co., 1219 Lombard Street, San Francisco, California

Mr. Stephen Galvin — Dr. John Jackson

Dr. Howard Spencer

Committee on History

1. The committee will submit to the Editor manuscripts covering history of the Institute with recommendations as to how they wish these published. These will be reviewed by the Editor and after consultation with the committee, the Editor will be prepared to make a recommendation at the December meeting of the Executive Committee.
2. Members of the committee will be selected to prepare the following reports:
   a. History of the Regional Sections.
   b. History and recipients of IFT awards.
   c. History of the IFT publications.
3. The present general history covers the period up to 1947. Work will be started to add additional years of history to supplement the original work.

Membership:

Dr. Zoltan Kertesz, Chairman, N. Y. Agricultural Experiment Station, Cornell University

Prof. Samuel C. Prescott, Honorary Chairman, Massachusetts Institute of Technology, Cambridge, Massachusetts

Mr. Fred Baselt — Dr. E. A. Beavens
Dr. William Cruess — Miss Dorothy Ann Huber
Dr. John Nair — Dr. Guy Woodroof

Committee on Membership

The objective of this committee is to initiate, guide and encourage local and national activities for increasing the national membership. Members are the secretaries of all regional sections.

Mr. Charles Flynn, Chairman, General Foods Corporation, 555 South Broadway, Tarrytown, New York

CHICAGO
Mr. Henry Furgal
NORTHERN CALIFORNIA
Mr. Dave Eolkin
NORTHEAST
Mr. Earl McFee
SOUTHERN CALIFORNIA
Mr. Robert McGrath
ST. LOUIS
Mr. Albert Rohland, Jr.
NEW YORK
Mr. Norman Ishler
FLORIDA
Mr. Howard Todd
WESTERN NEW YORK
Dr. Claude Bice
GREAT LAKES
Dr. Irving Pflug
PHILADELPHIA
Mr. Robert Lawhorn
MARYLAND
Mr. Warren Anderson
OREGON
Dr. Harold Schultz
DIXIE
Mr. Anjus Shingler
TEXAS
Miss Lanell Irvin
AUSTRALIA NORTHERN
Mr. F. Peter Muller
INDIANA
Miss Verna McCallum
PITTSBURGH
Mr. Brian Burke
BRITISH COLUMBIA
Miss Martha Poolton
AUSTRALIA SOUTHERN
Mr. Robert Miller
AK-SAR-BEN
Mr. Harvey Lantz
HAWAIIAN
Mr. Gordon Pickering
MEXICO
Emma G. Balboa

PUGET SOUND
Mr. John Simon

AMES
Dr. Frances Carlin

MOHAWK VALLEY
Mr. H. Charles Nixon

OHIO VALLEY
Dr. Wilbur Gould

WISCONSIN
Dr. Andrew Rice

MINNESOTA
Mr. Roger Hefty

KANSAS CITY
Dr. Harrison Newlin

JAPAN
Dr. Masao Fujimaki

WASHINGTON, D. C.
Mrs. Elsie Dawson

Committee on Nominations

The nominees for officers and councilors-at-large shall be selected by the Committee on Nominations as prescribed in Article VIII, Section 1, 2 and 3 of the Constitution and Article IX, Section 7 of the By-Laws.

Membership:

Mr. B. Grossi, Chairman, Gerber Products Company, 9401 San Leandro Blvd., Oakland, California

Mr. C. G. Beisel
Dr. Carl Koonz
Dr. Kenneth Morgareidge
Dr. W. R. Roy

Program Advisory Committee

This committee shall be responsible for making recommendations on long range policy in regard to annual meeting programs. These recommendations shall include:

1. A list of the phases of Food Technology which are appropriate to include in a program, especially any recommendations for changes from previously established patterns.
2. Any limitations on the number of papers and number of concurrent sessions which are appropriate for the meetings.
3. Any other policy matters which are pertinent to the conduct of the program at an annual meeting.

Membership:

Dr. Bernard Proctor, Chairman, Massachusetts Institute of Technology, Cambridge, Massachusetts

1959–1960

Dr. M. J. Copley
Dr. J. A. Dunn
Dr. H. E. Robinson
Dr. J. M. Sharf

1959–1961

Dr. George Stewart

1959–1962

Mr. Fred Baselt

Annual Meeting Program Committee

This committee is responsible for preparing the program for the 1960 Annual meeting in San Francisco, including the program for the Conference to be held in the Hawaiian Islands following the Annual meeting. The operations of this committee are prescribed in Section III and Section IVB of the Policies and Rules Pertaining to Annual Meetings of the Institute of Food Technologists.

Membership:

Dr. George Stewart, Chairman, University of California, Davis, California

Dr. Hans Lineweaver, Vice Chairman, West Utilities Research, United States Dept. Agriculture, Albany 10, California

Dr. Ralph Baker
Dr. George Felton
Dr. Dean Foster
Dr. Joseph Gast
Dr. Amihud Kramer
Dr. E. B. Oberg
Dr. W. S. Ogilvy
Mr. Edward Seltzer
Dr. Clarence Schmidt
Dr. Lee Underkofler
Dr. Betty Watts
Dr. John Whitaker

Committee on Publications

This committee has the responsibility and authority to investigate, review, study and recommend on any matters concerning publication policy to the Executive Committee. See By-Laws, Article IX, Section 6.

Specific assignments for 1959–1960 are as follows:

1. Study the matter of the Institute engaging in translation of Russian literature and make recommendations to the Executive Committee.
2. Work with the ad hoc committee set up to study the suitability of technical articles being presented in the journals.
3. Study and make recommendations regarding the publicity of Institute committee reports.
4. Review and approve page budget for the journals as submitted by the Editor before submission to the Executive committee.
5. Request has been received that the proceedings of the Pacific Rim Conference be published. The Program committee recommends that it be kept separate from our journals and if the Institute does not want to undertake it, they would like permission to have the Academic Press do it at no cost to the Institute. A recommendation should be made at the December Executive committee meeting so action can be taken.

Membership:

Dr. Howard Spencer, Chairman, Dow Chemical Company, Midland, Michigan

1957–1960

Dr. Samuel Goldblith
Dr. Hans Lineweaver

1958–1961

Dr. George Beach
Dr. William Esselen

1959–1962

Dr. Reid Milner
Dr. Howard Spencer

(Continued on page 36 following Technical Section)

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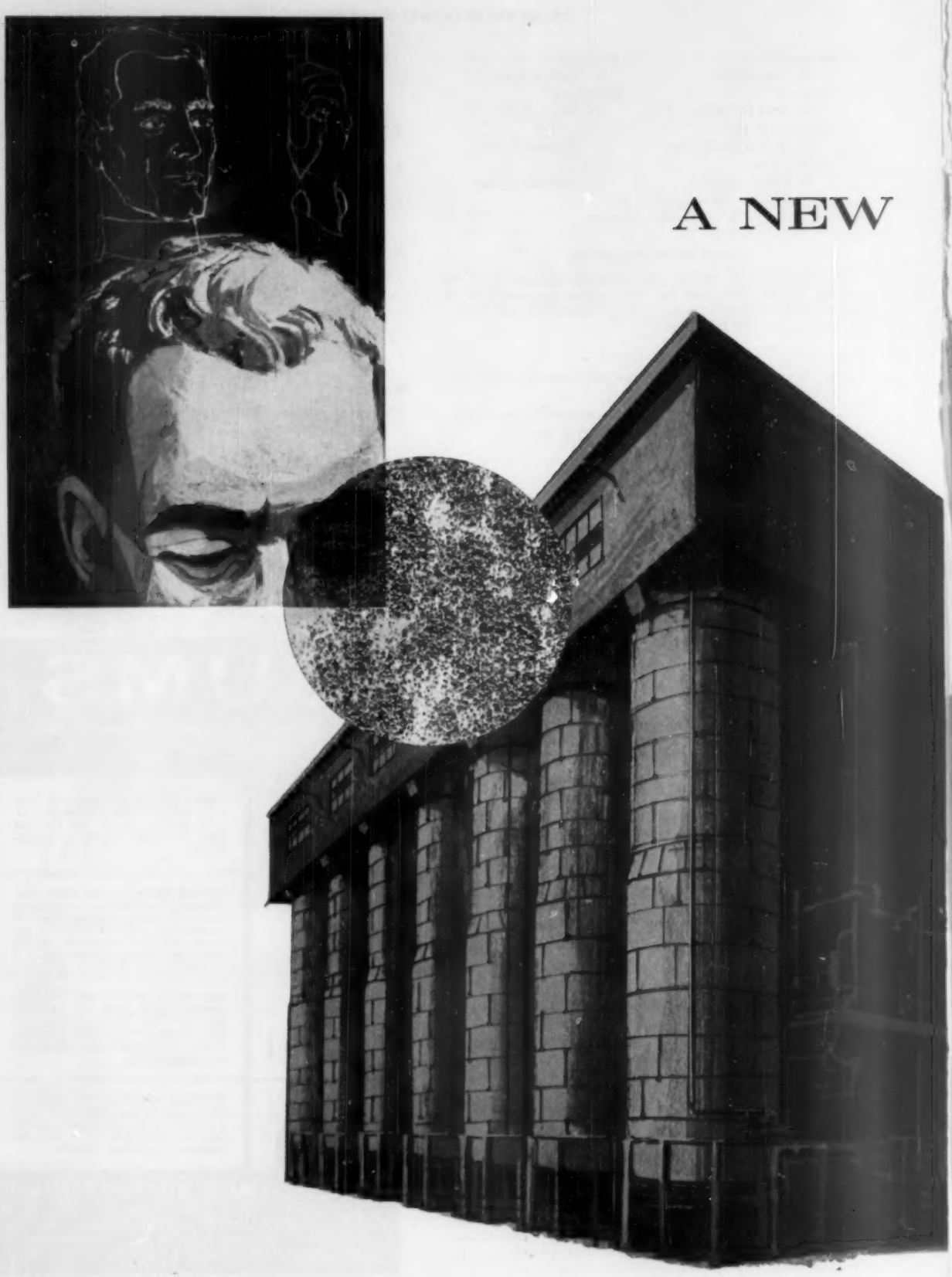

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Food Standards Symposium*

Moderator: Frank L. Gunderson

Introduction and Background

Frank L. Gunderson
Technical Consultant, Washington, D.C.

THIS SYMPOSIUM was arranged because of widespread belief that the Food, Drug and Cosmetic Act together with its Regulations on food have a very important bearing on the work and potential accomplishments of many food technologists.

Food standards in the advisory and voluntary sense were already increasingly known in the period 1905 to 1930. Butter was defined by a separate act of Congress in 1923. The "canned milk industry" asked for and voluntarily agreed to conform to a certain degree of concentration of the product years before there were mandatory standards. In 1930, the food canning industry encouraged passage of the McNary-Mapes Amendment to the 1906 Pure Food and Drug Act. It first made mandatory definitions and standards of identity for canned fruits and vegetables, also for canned salmon. It provided protection to consumers of canned foods and protection to canners against hurtful competition of inferior products.

Today we direct our attention especially to the Food, Drug and Cosmetic Act of 1938 and its Section 401 which states:

> "Whenever in the judgment of the Secretary such action will promote honesty and fair dealing in the interest of consumers, he shall promulgate regulations fixing and establishing for any food, under its common or usual name so far as practicable, a reasonable definition and standard of identity, a reasonable standard of quality, and/or reasonable standards of fill of container. . . . In prescribing a definition and standard of identity for any food or class of food in which optional ingredients are permitted, the Secretary shall, for the purpose of promoting honesty and fair dealing in the interest of consumers, designate the optional ingredients which shall be named on the label. . . . "

Between 1938 and July 1, 1958, composition Definitions and Standards of Identity of 182 foods were promulgated; 12 cacao products; 32 cereal flours and related products; 10 alimentary pastes; 5 bakery products; 10 milk and cream products; 61 cheeses, processed cheeses, cheese foods, cheese spreads and related foods; 3 dressings for foods; 13 canned fruits and canned fruit juices; 3 fruit preserves and jellies; 12 shellfish; 1 fish; 7 eggs and egg products; 1 oleomargarine; 6 canned vegetables; and 6 tomato products.

Some Pros and Cons of Standards

Among the pros or "benefits" of official standards are: promoting "honesty and fair dealing in the interest of consumers"; minimizing deception and confusion of consumers; simplification of official regulatory tasks; simplification of labels, since they then need not disclose all the ingredients; forestalling harmful ingredients; and prevention of inferior products which could compete unfairly with the manufacturer whose integrity and products-quality are high.

As to the cons or "disadvantages" of Standards of Identity—some believe that they are too inflexible with respect to the minor, and usually optional, ingredients; that formulation of foods has been taken away from food technologists and home economists, and has become a governmental administrative operation; that such action sets a "ceiling" of mediocrity over composition of foods under standards; that confusion of consumers is created by required label-listing of some ingredients and not of others; that incentives for both industry and university research toward ever finer composition have been stifled by excessive inflexibility of standards; and that small food processors (even more than the larger ones) are dissuaded or discouraged from creating interesting new revisions of standardized foods.

Reports on Standards

Relatively few reports have been published on this subject by food technologists. Beacham *(2)* explained that identity standards "establish the composition of the food and fence out those ingredients which do not properly belong there," and "provide for accurate and informative labeling." He described listing of optional ingredients, the standard-making procedure, discussion with industry, public hearings, and the need for cooperation.

Williams *(11)*, Chairman of a National Research Council committee, concluded that formal hearings are not conducive to the prompt and satisfactory resolution of questions of sicentific nature such as are involved in new chemicals proposed for use in foods. Also, the National Research Council committee stated that unless some remedy can be found for the cost in time and money which is involved in the 1952 method of standard-making procedures, a restraint upon the introduction of new food products seems very probable. And later Weckel *(10)* described the impact of certain standards on dairy products manufacture.

The Hale Amendment of 1954 *(3)* authored by Mr. Michael F. Markel, was enacted to simplify and expedite standards-making procedure in those cases which are not controversial and it has eliminated many

* A Symposium held at the Nineteenth Annual Meeting of the Institute of Food Technologists, Philadelphia, Pennsylvania, May 20, 1959.

Hearings. Meanwhile, other aspects of standards-making have complicated the process. One reason may be the inflexibility, or possibly the extreme limitation, of optional ingredients.

Citizens' Advisory Committee

In 1954 the Secretary of the Department of Health, Education, and Welfare appointed a Citizens' Advisory Committee, with 14 distinguished members. Mr. G. Cullen Thomas, Vice President, General Mills, Inc., Chr., and his committee in June 1955 reported their observations and recommendations *(9)*.

Regarding Food Standards the Citizens' Advisory Committee made observations from which these are relevant samples:

"Since 1938, FDA has established many sorely-needed standards. These have protected the integrity and quality of foods in which consumers, because of the frequency with which such foods are used, are entitled to find reliable attributes of purity, nourishment, flavor, color, and uniform composition; and under fill of container, non-deceptive packaging. They also have created criteria by which the industry may be guarded against unfair competition. These objectives are necessary, and should be continued to the maximum extent possible consistent with efficiency and public interest.

" . . . .

"With advances in food technology and changes in American food habits, there are many items, particularly in the 'convenience' food field, for which standards are urgently needed. These include, among others, such products as frozen fruits, frozen juice concentrates, frozen fish of many species, canned salmon and tuna, frozen vegetables of several varieties, and frozen fowl."

The Citizens' Advisory Committee made recommendations that the FDA:

" . . . .

"Concentrate its resources more on standards where problems of major importance are involved and devote less time to areas where there is little controversy.

"Provide flexibility in food standards to permit of change for the improvement of quality or value, or the introduction of new varieties or forms."

Expressions in 1957

Experts from both the legal and scientific professions, and from food processing industries and the federal Food and Drug Administration wrote a series of articles on food standards in 1957. "Unshackle the Improvement of Food Products By Simplification of Food Standards" was the title of Markel's *(7)* proposals. Subheadings of his article suggest the gist of his proposals, viz: "Recipe writing or standardizing?," "Fixing optional ingredients not essential to economic integrity," "Existing standards go beyond demonstrated needs," "Safety via standards a temporary expedient," and "Let food technologists be chef." Markel stated that "Insurance of economic integrity was the basic objective of the food standards" but that such an interpretation was not stressed in early litigation. Twelve food industry men wrote in general approval of Markel's views *(5)*.

FDA Commissioner George P. Larrick *(6)* disagreed with the criticism directed at the Definitions and Standards of Identity of Foods. Larrick said that in the absence of any example of "shackling" by food standards, that Markel's discussion seems more theoretical than practical. Commissioner Larrick pointed out that color and flavor, the two principal examples of culinary art cited by Markel, are permitted in just these terms with few exceptions, and were singled out by Congress as optional ingredients that need not be declared by common name in standardized foods. Larrick dissented from the idea the consumer would be adequately protected by the provision which Markel called "economic integrity." Larrick believes the promulgation of standards has not closed the door to improvements in nutritional or other qualities of food.

Mr. Larrick concluded his statement of 1957 by asking if the,

" . . . outcry against the basic principles of standard-making which the courts of the land have determined are in the public interest isn't really a protest against the unwieldiness of the present procedures for dealing with chemical additives, which he recognizes would be corrected by new legislation dealing specifically with that question?"

Markel commented further on the above points *(8)*.

The Institute's Program Committee hoped the Food and Drug Administration would be represented in this Symposium. Thus, in mid-1958 the FDA was the first to be invited. While that invitation was pending Markel was invited to speak from the legal viewpoint and he provisionally accepted contingent on FDA's acceptance. It is disappointing that FDA and Markel could not participate in this discussion. In declining, FDA wrote in December 1958 as follows:

" . . . We regret that it will not be possible to have an FDA representative participate in that discussion.

"It appears to us that the discussion must center, at least in part, on a proposal to amend the Food, Drug, and Cosmetic Act. We do not know what the proposal is but have been advised that it will be suggested to the new Congress. As we explained by telephone, the Department's position on proposed legislation is determined by the Secretary's office and of course the Department can't state a position until it knows what is proposed. It would place a Civil Service employee in an untenable position to expect him to participate in the panel discussion under these circumstances."

There seems to be (in May 1959) no evidence of any new bill on this subject despite the fact the Food, Drug and Cosmetic Section of the New York Bar Association in early 1958 adopted the following resolution:

"RESOLVED that this Section favors in principle legislation amending the Federal Food, Drug, and Cosmetic law, which will provide flexibility in food standards to permit change for the improvement of quality or value, or the introduction of new varieties or forms, and which will provide for fixing only those ingredients necessary to safeguard product identity and economic integrity."

HEW Secretary Flemming's Conferences of December 1958

On December 11, 17, and 18, 1958, a Series of meetings were held with Representatives of National Organizations by HEW Secretary Flemming pertaining to the activities of the Food and Drug Administration. FDA's summary states on the Standards matter:

" . . . .

"III. Food Standards and Economic Cheats. Some food industry representatives asked that standards be less rigid, or perhaps abandoned altogether, so technological progress will not be hindered. Other industry representatives endorsed food standards provided FDA enforces them strictly. Consumer representatives supported standards and standards-making procedures and requested strong enforcement in this area.

"Other suggestions:

"A. That industry opposition to standards may be due to lack of enforcement and inflexible attitudes of FDA.

"B. That FDA reevaluate the entire area, considering budgetary needs, operating criteria, flexibility of standards, and faster standards making procedures.

"C. That standards be established for specialty as well as basic foods. . . . "

Several Current Opinions

A few months ago another leading food and drug attorney, Mr. H. Thomas Austern of Washington, Chairman of the Food Standards Committee of the New York Bar Association *(1)* said standards are worthwhile and that when those standards are well formulated they serve a useful purpose for the consumer and are likewise helpful to the food industry. Mr. Austern then expressed preference for an administrative revitalization of the standards program rather than an amendment of the law.

And now, the very latest event in this "background" is by FDA's Deputy Commissioner, John L. Harvey *(4)*. Mr. Harvey stated the FDA believes it is administering the law as it is written, and as it was interpreted by the Supreme Court in the Quaker Farina case and by the Circuit Court in the Atlas Powder Merj 45 case. Mr. Harvey wrote:

" . . . The Quaker Oats case long ago settled the Department's right in standardizing foods to consider all proposed ingredients and to specify the number, names, and proportions of ingredients, however wholesome other combinations might be.

"The justification for standardizing enriched farina was the potential consumer confusion. This would likely have resulted from a variety of enriched products, as to which an intelligent choice could not be made by the average buyer because she was uninformed as to the relative value of various vitamins and minerals.

"More recently, the Court of Appeals for Third Circuit in the Atlas Powder Company case affirmed the bread standard after observing that we had made a careful effort to do what Congress authorized, in the way Congress indicated it should be done.

"Significantly, that order involved a lack of knowledge and negative findings—both of which, it is argued, may not be used to exclude a proposed optional ingredient.

"The use of the licensing argument is not new. Neither is it at all applicable to what we are doing. . . .

"Plainly, we are bound by what Congress has written, and we cannot provide different criteria which ignore the function, dietary role, and consumer interest in proposed optional ingredients.

"The basic argument appears to be that the producer of food should be free to add to a standardized food any wholesome ingredient whatever, so long as he uses informative labeling.

"This precise argument was made in and rejected by the Supreme Court in the Quaker Oats case.

"It seems to us that we are asked to wholly ignore this decision and to allow modification of standards for any reason or for no reason at all. This we cannot do, even if we were of a mind to.

"Finally, we have imposed no undue impediments on food progress in standardization. We introduced the temporary permit system to facilitate market testing of new ingredients.

"We have attempted to work out as informally as possible all conflicts over proposals. And we have handled the proposed amendments as fast as our very limited personnel would allow.

"At the moment, we are striving to improve this, and we can promise that we will improve the program. . . .

"We do not consider it good government for administrators apparently to approve a practice which the Congress itself has forbidden by the general terms of the law."

The immediately preceding comments are by Mr. John L. Harvey, Deputy Commissioner of FDA. Such is the background of Definitions and Standards of Identity of Foods to May 1959. Food technologists can be expected to show increasing interest in the subject just as consumers and others should do. To be most meaningful the merits of the practice, and consideration of changes should be on a point-by-point basis. It is expected that many "little improvements" could together go a long way toward over-all benefits for our total population. To at least some technologists the Act, its regulations and court decisions appear not to require severe inflexibility in the optional ingredients. The Citizens' Advisory Committee in 1955 had full view of all those circumstances when they recommended "flexibility" as described above.

LITERATURE CITED

1. Austern, H. Thomas. The current status of the Food Standards Program. *Food Drug Cosmetic Law J.*, **14** (3), 210–226 (March, 1959).
2. Beacham, Lourie M. Why and how—Standard making. *Food Drug Cosmetic Law J.*, **6** (3), 167–173 (March, 1951).
3. Federal Food, Drug and Cosmetic Act, Sec. 701 (b) to (g), as Revised to March (1959).
4. Harvey, John L. FDA states its position on identity standards. *Food Processing*, 20 (5), 29 (May, 1959).
5. Industry leaders, comments by. *Food Processing*, **18** (7), 34–35 (July, 1957) and **18** (8), 38–39 (August, 1957).
6. Larrick, George P. "Recipe writing" necessary. *Food Processing*, **18** (9), 31 (September, 1957).
7. Markel, M. F. Unshackle food improvements by restricting FDA Food Standards to fixing only those factors which are essential to food identity and economic integrity. *Food Processing*, **18** (6), 21–23 (June, 1957).
8. Markel, M. F. Answers to Commissioner Larrick's Comments. *Food Processing*, **18** (10), 34–36 (October, 1957) and **18** (11), 35–37, 42–43 (November, 1957).
9. Thomas, C. G. Com. Chr., Report to the Secretary of Health, Education and Welfare, by the Citizens' Advisory Committee on the Food and Drug Administration, pp. 44, 85 (June, 1955).
10. Weckel, K. G., Jr. Impact of food and drug definitions and standards of identity on dairy products manufacture. *J. Dairy Sci.*, **40**, 1501–1505 (1957).
11. Williams, R. R. Standards of identity for foods. *Food Drug Cosmetic Law J.*, **7** (9), 556–572 (September, 1952).

What Informed Consumers Expect from Food Standards

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IT IS A PRIVILEGE to have this opportunity to discuss food standards from the consumer's point of view. The Food Additive Amendment has spurred the public's interest in food regulations, and the time is ripe for examining and evaluating present legislation and practice, and for keeping consumers informed of your work.

The question, "What do informed consumers expect from food standards?" raises other questions that are equally thought-provoking. All of them have to do with changes. To consider these changes, we have to look back a few years and ahead a few years. Among the things to think about are:

- Changes in the numbers and kinds of food products on our markets.
- Changes in our food shopping practices.
- Changes in age groups in the population.
- Other changes in people—their eating habits, their ways of living, their education.

Reflection on these changes leads to further questions:

- Who are today's and tomorrow's consumers?
- What do they expect from the food supply and from food standards?
- How can they become better informed?

Changes in the foods in our markets. Changes are coming practically overnight. Americans expect a great deal of the food supply, and they take much of what they expect for granted. By and large, we accept as a matter of course that the foods we buy are sanitary; we have little concern about adulteration. And we expect the food industry to continue to supply us with a multitude of food products for everyone, for everyday use and for special use. It does this task remarkably well. Infant foods, low-calorie foods, low-salt foods, foods for special nationality and religious groups, foods for busy homemakers, foods for gourmets, foods for every taste—all these are available.

Today's supermarket handles over 5000 food items —an increase of 2000 since 1946 and 6 times as many as the grocery store of 30 years ago *(5)*. About ⅓ of today's foods have come to market in the past 10 years, and about 200 new food products appear each year *(8)*. Many of these newcomers are ready-to-mix, ready-to-cook, or ready-to-eat.

Not all of these new products become best-sellers, but the market for prepared and partially prepared foods continues to grow. The April 6 issue of *Food Topics* included an article by John Seabrook on the growth of the frozen food industry that illustrates this point *(13)*. Frozen foods accounted for 1% of the total grocery volume in 1947, and over 6% 10 years later, according to Seabrook. He adds that, in 1957, frozen prepared foods accounted for 2% of the total but now they add up to more than 26% of all the frozen food production. The 8-fold increase in production of frozen breaded shrimp from 6.6 million pounds in 1950 to 51 million pounds in 1957 is just one example of the growth of this industry *(1)*. The rapid developments in frozen foods illustrate how much more complex food selection is for the homemaker than was true formerly.

Technological advances have brought us more and better foods, in more convenient forms, at remarkably reasonable prices. Our choices are beyond the dreams of most food shoppers of even 10 years ago—including mixed fresh fruit, quick-cooking potato flakes, instant desserts, and whipped cream in push-button cans, to mention only a few. More kinds of food and more forms of food are available than was true even a year ago.

Changes in food shopping practices. As well as having more choices, our way of buying food has changed. Telephone orders and home deliveries are no longer commonplace; nor is it customary to have the grocery clerk on hand to select the items we want. As buying food has become a "do-it-yourself" affair, consumers have more opportunities to compare various products than formerly.

Then too, the equipment we have in our homes provides us with many relatively new possibilities for storing and handling food. One out of 5 homes had a freezer in 1958 *(11)*, and the number of small electric appliances in homes—including mixers, blenders, deep fat fryers, fry pans and rotisseries—has grown by leaps and bounds. All of these changes influence our purchases and uses of food.

Changes in age groups in our population. Another change worth attention is our growing population—with more youngsters and more older citizens. Both these age groups point to a growing market for special kinds of food. The baby boom has been going on for years, and the market for dietary foods, including products for the allergy-sensitive as well as the overweight, also is expanding. Persons with dietary problems need to be well informed about *all* the foods they buy. This has been recognized by the labeling regulations of the Food and Drug Administration regarding dietetic foods.

Changes in people. Along with these changes, it's appropriate to think about changes in people—changes that make them more knowledgeable about foods. Recent studies by Michigan State University and by the U. S. Department of Agriculture indicate that knowledge of food grades, food standards, and qualities and appropriate uses of food increases with a higher than average income and higher than average education *(9, 10)*. These consumers get more of their information on food from newspapers, magazines, and pamphlets than do the less well informed. As long as the average income continues to rise, and as long as more people continue to go to high school and college, we can expect more informed consumers as each commencement comes.

Have businessmen met their obligation in public affairs?

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Business, large or small, operates in a world in which powerful forces are at work marketing ideas that undermine our political and economic system. The public is being hoaxed into believing that the nation can consume more than it produces, that our standards of living can be increased by restricting output and reducing hours of work, and that the "good life" is a life of irresponsibility. The belief is fostered that through taxing and spending a more powerful central government can take care of everything.

We believe management leaders must find a way to put industry in its true perspective, and to convince the public that our principles and methods are in the interests of everyone, not just a few.

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SECOND—we let every employee know exactly what we stand for, and why. We provide them with a constant flow of facts and viewpoints. We are hopeful their good sense will lend support to our ideas.

THIRD—we give our managers the opportunity to study political processes and learn the art of practical politics. We urge them to take an active role in local politics in the party of their own choice—on their own time, at their own expense.

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TODAY'S AND TOMORROW'S CONSUMERS

The informed consumer. This brings us to the questions, "Who are today's informed consumers? And where are they?" They are many if you think in terms of thousands; they are relatively few if you think of 170 million. They include a large number of food writers and information specialists with magazines, newspapers, radio and television stations as well as those with city, state, and federal educational agencies. They include home economists in business, and home economists who teach in high schools, colleges, and in Cooperative Extension programs for the public which stem from the land-grant colleges. They include professionally trained technologists, and they include lay persons who are keenly interested in foods.

Today's informed consumers are everywhere—you'll find them in the city and in the country, in the supermarket and the specialty shop. They include both men and women—more every year. At the New York State Home Economics Association Convention this month, Augusta Clawson from the Women's Bureau of the U. S. Department of Labor reported that 8 thousand college students received the B.S. degree in home economics or home economics education in the academic year of 1957–58. She also pointed out that of the 80 thousand home economists in this country, 44 thousand are teachers. Connecticut alone has 3300 professional home economists, according to a recent issue of the *Journal of Home Economics (4)*. Not all home economists specialize in foods, but those who know foods and food standards have a wide influence.

Label-reading. The discriminating food shopper of today needs knowledge and skills that are quite different from those of the careful shopper of 10 years ago. Home economists encourage food shoppers to develop skill in label-reading and this means that they have to learn about two kinds of labels—those for foods for which mandatory standards exist and those for other foods. Homemakers rely heavily on brand names when they select canned and frozen fruits and vegetables, according to a recent report from the U. S. Department of Agriculture. But they like to have additional information on the label whether they use it or not, and they consult the labels on frozen foods often to find out how to store and use these products *(12)*. This practice indicates that the information on labels is likely to be used more and more, as more new products appear on our markets.

To develop skill in label-reading is not an easy matter. Many homemakers are not familiar with the labeling laws that apply to foods over which the Food and Drug Administration has jurisdiction. When I discuss food labels with homemakers in extension meetings, they usually do some preliminary label-reading before the meeting—comparing different brands of frozen poultry pies, or canned creamed soups or spaghetti sauces, or enriched bread. Time and again, homemakers have been surprised to learn about federal identity standards and that the foods for which mandatory standards exist are not required to have a list of ingredients on the label. They are confused by the fact that some foods have a complete list of ingredients on the label, some a partial list, and others have no list of ingredients. They are surprised, too, to learn that the listing of foods is a clue to their relative predominance, and that this list can help them to select products their families will enjoy.

The names of many of the ingredients in prepared foods are unfamiliar to most homemakers. They have little basis for knowing the functions of these ingredients; they are inclined to be leary of long, complicated terms. If they have access to the Federal standards for specific foods such as bread, or cheese, or jellies, or canned fruits, they find these standards difficult to understand and interpret.

Understanding food standards. The more I learn about food standards, the more impressed I am by the fact that so many consumers are so well informed. I have already pointed out that information requires some real hunting to find and that the language is difficult for the lay person to understand. What is more, the language of food standards does not make food sound palatable or attractive. How can we expect many people to get really enthusiastic about "emulsified viscous fluid food," "striated muscular tissue of fish," or a "homogeneous plastic mass" prepared by "comminuting and mixing" optional cheese and dairy ingredients? These phrases scarcely suggest French dressing, tuna fish, and process cheese food. The language reminds me of a Mr. Ellsworth, who told his friends in a roundabout fashion that he prefers to travel by bus. This is what he said: "Being situated in such a location as I am with reference to Main Street, and not particularly caring to cope with the difficult parking situation which appears to become more extreme each year, and not otherwise feeling the necessity of owning an automobile, I find it a real convenience to utilize the seemingly efficient public transportation system."

To get back to the problem of understanding food standards—study of a list of products for which mandatory food standards exist leaves the consumer somewhat puzzled. Some classes of foods are highly standardized and others are not standardized at all *(7)*. Some standards have broad application—those for jellies and jams, and for sirups for canned fruits, for example. Other standards are quite limited in their application. Most everyone eats generous amounts of some of the foods for which we have standards—including enriched bread, canned peaches, corn, tomatoes and fruit cocktail. But we also have standards for foods we use seldom and in small quantities—such as prickly pear jelly, or canned apricots with rum. Some foods with standards are more important regionally than nationally—as hominy grits and enriched rice. Some are luxury foods—as fresh oysters and canned mushrooms. Family food shoppers rarely buy some of the foods with standards—as dried and frozen eggs, but they want clear definitions of others that they use in small amounts—different kinds of tea, for example *(7)*.

Criteria for understanding standards. Consumers who have followed standards closely enough to know the nature of recent amendments are aware that flexi-

ble standards are desirable for economy and variety. Among the criteria for establishing standards might be these:

- How much of the product do we use? How often? How important is it in our diets?
- How great is the opportunity for an inferior product if there are no standards?
- How big is the product's share in total production? Or how rapidly is its production growing?
- Does the standard help to maintain the integrity of the product?
- Does the standard permit development of a better product?

Consumers welcome the news that standards are in the offing for some of the products that are relatively new or that they choose more and more often—products such as fruit beverages and ice cream. They look forward to standards that will help to maintain the integrity of the prepared foods that come to market in increasing amounts—products such as mixes for fruit pies, breaded poultry, fish and shellfish. Those who know food standards are more concerned with the minimum and maximum amounts of the chief ingredients than with a complete formula that dots every "i" and crosses every "t."

Interpreting food standards—a difficult task. We who are in the business of consumer education and consumer information are making considerable effort to interpret food standards to the public. We do not find this an easy matter, although we have access to fine libraries and have splendid help from Federal and State officials. There is more than one reason why the task is difficult:

- As we delve into food standards we find both voluntary and mandatory ones—and we have to check with several agencies that have authority regarding mandatory food standards for identical products. The U. S. Department of Agriculture, the Food and Drug Administration, and the State Department of Agriculture and Markets may all have a voice in the standards of one product *(3)*.
- Information regarding state and federal standards is piecemeal and ferreting it out requires considerable detective work.
- We find the language of food standards difficult to interpret accurately in everyday words.
- We find that keeping up-to-date on changes in the status of food standards—voluntary, proposed, or mandatory—requires considerable patient attention *(6)*.

In our Cooperative Extension program in Food Marketing Information for Consumers, our staff in New York City and at Cornell University has developed a series of reference stories on various commodities *(2)*. These stories are distributed to foods editors, radio and television program writers, extension agents, advertising agencies, schools and libraries. The section on dairy products has stories on butter, cheese, ice cream, and milk; the section on fats and oils has stories under way on lard, margarine, oils, and dressings for salads; the section on cereals has a story on bread and the section on fish has stories on both fish and shellfish. Each of these stories required some discussion of standards, in language that will be easily understood. This takes time—more time than the food editor or the public information worker usually can spend on a short paragraph. These mass media specialists, however, find myriads of uses for clearly stated information on food standards and food labels. Their audiences are vast, their influence is tremendous. We who are in the field of consumer information would welcome simple descriptions of food standards. This would free more of our time for other kinds of food information. I am speaking not only for the 6 staff members in New York State and the Metropolitan New York area but for over 100 workers in 40 states.

Because of the complexity of our food supply, the number of well-informed consumers will remain small until we have more readily available, easy-to-read information that describes food products accurately. I have asked some of my colleagues what suggestions they would offer regarding identity standards and food labels. From our conversations, several suggestions have come on which there is general agreement:

- Labels need to give information in simple language that is easy to read and to understand. We know that you are keenly interested in finding ways to simplify technical terminology, and we are strongly in favor of this effort.
- A statement or a seal to the effect that a food meets Federal standards of identity would be helpful. This might be a brief phrase "meets Federal standards" or it might be an official seal to the effect that a product meets Food and Drug Administration standards. The seal of the American Standards Associations is a precedent along this line that is worth consideration.
- A list of ingredients in addition to the statement on Federal standards would be informative. Even if you are well read on food standards, it is practically impossible to keep the details in mind. A message at the point of sale and at the point of use would be valuable. This list might say "from most to least" or "in order of amounts." Perhaps it's going too far to suggest a standard place for the list of ingredients on all products—but designers of labels could make the list easy to find. Too often the shopper has to turn the package over and over to find this list. A good many shoppers need their bifocals to read the print; sometimes they say they need a microscope!

NEEDED: ACCURATE, EASY-TO-UNDERSTAND, UNBIASED INFORMATION

To conclude, I would like to reiterate that informed consumers know why food standards have evolved, and what they mean. They understand that the establishment of standards is a slow, complicated process. They know that the information on the label of food products indicates whether or not the foods are standardized. They are asking for additional stand-

ards for relatively new food products, provided such standards help to maintain quality and nutritive value. At the same time, they want these standards to permit individuality in products and they want this kind of protection to be provided as economically as possible.

We expect the food industry to continue its remarkable progress in providing us with foods that are high in quality, readily available, easy to store, and easy to use. As this progress continues, we look forward to equal progress in providing helpful and dependable information to consumers.

The signs of the times point to a growing need for the public to have access to accurate, easy-to-understand, unbiased information on food. Both the food industry and the Food and Drug Administration can take advantage of the current interest of the public in the foods they buy—the time is right.

LITERATURE CITED

1. Alberti, L. R. Let's give breaded shrimp a chance. *Quick Frozen Foods*, 21 (9), 112 and 119 (April, 1959).
2. Bread (1955); Butter (1956); Cheese (1955), Ice Cream (1958); Milk (1956); Fish (1953); Shellfish 1956); Lard, Margarine, Oils, Dressings for Salad (1959). *Extension Food Marketing Handbook*. Cooperative Extension Service of New York, New Jersey, and Connecticut.
3. Christopher, Thomas W., and Dunn, Charles Wesley. *Special Federal Food and Drug Laws — Annotated*. 48–54. Commerce Clearing House, Inc. Food Law Institute Series.
4. Eckhardt, Elizabeth. Connecticut groups assemble home economics directory. *J. Home Econ.*, 51 (4), 285–286 (April, 1959).
5. Facts in grocery distribution. 25th Annual Report. *Progressive Grocer* (1958).
6. *Federal Register*. Amendment to jelly standard permitting cinnamon flavoring (September 5, 1958). Amendment to bread standard permitting wheat gluten addition (April 7, 1959).
7. *Foods for which standards have been established under the Federal Drug and Cosmetic Act*. U. S. Dept. of Health, Education, and Welfare. Food and Drug Administration. (July, 1958).
8. Harris, Roland G., and Durskin, Philip B. Convenience foods and their cost to consumers. AMS-267. U. S. Dept. Agr. (August, 1958).
9. Holmes, Mary Strickland, and Shaffer, James D. Some indications of homemakers' knowledge about food buying and attitudes toward food information. *Quart. Bull.*, Michigan Agr. Exp. Station, 3, 640–649 (1959).
10. Hoobler, Sharon Q. *Homemaker values, motivations, and knowledge in food buying*. AEP21. U. S. Dept. of Agr. (March, 1959).
11. Hotpoint makes freezer sales forecast for next 10 years. *Freezer Provisioner*, 13 (2), 12 (February, 1959).
12. Levine, Daniel B. *Consumers appraise canned and frozen foods, their packages and labels in Atlanta, Kansas City and San Francisco*. Marketing Res. Report 270, U. S. Dept. Agr. (September, 1958).
13. Seabrook, John M. Size up prepared foods via profit checks. *Food Topics*, 14 (7), 14 (April 6, 1959).

The Pro and Con of Standards of Identity:

Viewpoints of a Professor

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There is little reason to assume the viewpoints about the Standards of Identity by one in academic work should be much different from those in industry. Those in academic work collaborate closely with those in industry, and frequently undertake research projects of specific interest to them. The approach to certain aspects of Standards of Identity may differ because of *modus operandi* in academic work.

A question can well be raised as to the further necessity of the Standards of Identity. It was originally invented to enable (a) fair trade, and (b) understanding of integrity, and acceptance of foods, by the consumer. The Standards were conceived to correct a number of ills inherent in the previous regulations. In retrospect, there was necessity to correct the errors, evils, and hazards that existed in the handling of foods. The 1938 Act, however, provided other levers which helped attain integrity and fair trade; two may be cited; (a) the strict use of the per se doctrine in evaluation of additives; and (b) the concept that consumers had every right at bar to assume a safe and wholesome food was implied in warranty in a sale. Some 20 years have elapsed since the procedure for the establishing of standards was created. Tremendous advances in technology of foods have been made in the interim. The use of the Standard has not apparently, induced the utilization to the fullest of such developments.

The necessity, or effectiveness, of the Standards of Identity may be considered in terms of other criteria. There is in this country, providence in foods. The

granaries bulge; the warehouses are stacked. The platform, if not the fate of political parties, and the budget of the nation is influenced by the bounty of food. The availability of food is credited with the "creation and development of the standard of living" in this country as we perceive it now.

THE STANDARD OF IDENTITY: IS IT ESSENTIAL?

Is then, the Standard of Identity essential, and does it contribute effectively to fair trade and integrity, under this situation? On the other hand, would the elimination of the Standards have undesirable effects? Would we be willing to exchange the quality of a Standard of Identity food as available prior to 1938 for that we have now? Would the foods within the Standards list have improved in quality commensurate with the non-standard foods, in the interim? Further, what would be their acceptability in absence of Standards, and in the light of the newly adopted food additives amendment?

The term "recipe standard" is frequently used to describe certain portions of the Standards, or in some cases, to indicate the Standard is a recipe. The procedure, prior to the Hale Amendment, was not practical or realistic for modification of the Standard. There is widespread concern that with the Hale Amendment, it is still not realistic to do so. In effect, the Standards as described are fixed or frozen to the knowledge extant when written. In the some 20 years since then, tremendous advance has been made in understanding the sensory acceptability of foods. Ratios, levels, forms, shape, color of components are being given careful scrutiny. Hardly a firm, or laboratory organization is without facilities and funds by which to determine these values. It is proper to assume, in what is known about such work, that products within the Standards list could be much improved by incorporation of the new found knowledge. Obviously, this is not being done to the degree possible, and thus the potential benefits passed on to consumers.

EFFECT ON RESEARCH

The relative lack of research interest in the Standards per se, with respect to recipe form, must be considered in the light of the inherent *modus operandi* of academic institutions. Educational institutions, particularly the land-grant colleges, and more especially those engaged in food technology, have three categories of job assignment:

(a) teaching students
(b) conducting extension activities
(c) undertaking research

A well-organized college program in food technology must be in balance among these activities. Colleges of Agriculture are supported in great part by local taxes and thus have allegiance and responsibility to the State taxpayer. In the long pull, it is fundamental that the three job requirements in food technology be geared to the needs of the State. The research programs are supported by State, Federal, and industry funds. The selection of projects for study is necessarily geared to availability of talent, facilities in research, and the pressing needs within the state. Some fundamental, as well as applied research, is essential to a research program. Sometimes the projects are selected on the basis of urgency of information. At other times, by capability of the supervisor. In any event, there is emphatically relatively little inducement to undertake study of recipe standards in the face of the demands, needs and criteria for selection of projects in the academic organization. The historical experience of mechanics of Standards of Identity, and their modification has been one of frustration and delay. There is no incentive to be derived from this history that will lead, except where vital, to study at college level, of such products where the data is most likely to be ignored and lie buried. One of the essentials of academic membership, and advancement, is the publication and release of useful data, at the fundamental and applied levels. There is almost a mandatory responsibility to publish the data for which effort involving public facilities and moneys have been expended. In this respect academic institutions differ from industry organizations.

In the light of the "status quo" history of the Standards of Identity, it is difficult to convince the college administrative director that research on product or components or methods that are substantially frozen or fixed is more fruitful than many other far more pressing problems, or potentials. This in effect, diverts research to non-standard items. Prior to the Hale Amendment, the establishment of standards was considered painful; the changing of such standards perhaps equally so. This was not an incentive to institutional research on these products. It can be illustrated by example.

Butter, and nonfat dry milk, are defined by statutory definition. Butter was defined by Act of Congress in 1923, and included by reference in the 1938 Act. Although modification of butter to produce a wholesome nutritional and less costly new product is technically feasible, apparently no change, or proposal for change in the Standard has been made in the interim *(1)*. The place of butter in the diet, for want of possible modification, has declined considerably in the past 15 years. The identity of skim milk powder was established by federal statute in 1941 (nonfat dry milk solids). There are a number of possible modifications of this product through the use of additives. Nonfat dry milk is in need of nutritional balance, and this is becoming of great importance domestically. In comparison, considerable research and improvement is being made in the formulary balance of instant type chocolate milk for which no statute law or standard of identity exists. Both butter, and nonfat dry milk, must undergo statutory review. They seem to illustrate a "status quo" effect. One of the earliest standards of identity developed within the 1938 Act was for evaporated milk. Although a number of experimental modifications of this product have been conceived, none has been proposed. This standard not only defines composition, but also

methods of process. Only recently a permit enables aseptic fill of this product. A canned milk product in which vegetable fats were substituted for butter fat was developed many years ago. It was excluded from interstate trade by the Filled Milk Act. It is, however, produced extensively statewise, and the prohibitive effect of the federal statute greatly diminished. Is this conducive to institutional research on the product evaporated milk for which there do exist technical problems? Recent developments in sterile concentrated milks have many potentials of form and application. But the fruit of this loom may have to undergo the limitations of the standards.

Although a long list of common foods were identified fairly early by Standards of Identity, such as bread, flour, evaporated milk, canned foods, it took some 16 years before an initial proposal was published for ice cream. Hearings were first begun in 1942; some 9 years of postponements and delays resulted in the proposed definitions being published in March 1958. The hearings involved a total of some two years over a five year period. What is the fruit of potential research in this procedure? What is the subsequent attraction to further research once the standards are promulgated?

Various state food standards tend to encompass the federal standards when such products are not produced locally. Frequently, however, local definitions involve different names and terms, and often composition. The variation in local or state regulations is, of course, especially difficult for manufacturers of perishable as well as non-perishable products who operate across state lines. There is increasing interstate trade in perishable type commodities. Standards of Identity can be helpful; they can also be complicating where state standards are different.

There are many areas in which improvement of nutritional, economic or other quality value of food products may be echieved by use of select functional agents, or by reformulation of the ingredients. The temporary permit, which forestays the application of the "purports to be" rule, is a useful tool offered by the Food and Drug Administration and which should be used more extensively but collectively, by industry in development of changes in existing standards. This could be a means by which institutional research could be more readily induced to survey Standard of Identity products for their improvement. The Hale Amendment procedure imposes, in practice at least, the burden of expense for improvement of a product, upon a proponent. In this respect, there is a great need also for collective action in dealing with specific state regulatory standards, which also are in effect, standards of identity.

There is further need for standard of identity terminology for benefit of housewives, to correct labeling variations. For example, there are on the market four types of aerated pressure dispensed creams: table, and whipping cream, both made with vegetable, or butter fat. Because of want of identity, or better terminology, the consumer is "hard-put" to discern the nature of the purchase. Better standards would benefit both consumer and industry. In the light of such situations as this,—

There is need for research, and better understanding of a) the magnitude of the variations in common products, b) the confusion that occurs with the products, and c) in the potentials of standards for the products, if the principle of Standards of Identity has any value at all. There are notable examples where marked confusion exists in marketing certain classes of products, which could well be corrected by realistic standards.

NEED FOR RE-EVALUATION

There is a tremendous need for re-evaluation of existing standards to correct for changes and developments that have occurred in the interim. In the agronomic field alone there has been intensification of acreage, increased irrigation, new harvest machinery, new process equipment, and certainly new varieties of crop. Yet there seems to have been no examination of these developments relating to specific standards specifications such as alcohol insoluble solids of peas, fibrosity of beans, or in the methodology of such tests. Perhaps what is needed in the Standards of Identity program is a mandatory provision for periodic reappraisal of the Standards, and of the facts by which the original Standards were brought into being.

LITERATURE CITED

1. Weckel, K. G. Impact of Food and Drug Definitions and Standards of Identity on dairy products manufacture. *J. Dairy Sci.*, 40, 1501–1505 (1957).

An Industry View of Federal Definitions and Standards of Identity of Foods

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ANY SURVEY SUFFICIENT to determine the food industry's opinion of Federal Definitions and Standards of Identity would involve correspondence with a large number of food processors and distributors carefully selected as to size, location and type of food in order that the ideas came from a representative cross section of the industry. The survey reported at this time has no such breadth, and no claim is made that it represents a cross section of the American food industry.

Letters were directed to research directors of relatively large food research laboratories and to some executive secretaries of trade associations. The recipients were generally supporters of the Nutrition Foundation or members of the Liaison Panel of the Food Protection Committee, or were personally known to have an interest in food laws and regulations. Each one was told of this symposium and his suggestions for subjects to be discussed were solicited. Merely as an outline of topics to be considered, a one-page questionnaire was included. Had the author realized the interest that would be shown he would have been much more careful in framing the questions. Many did not return the questionnaire, some filled it out completely, wrote comments on the reverse side and also included a two- or three-page typewritten letter. Over 90% of the original recipients replied and no follow-ups were made. A small notice in the April issue of *Food Processing* mentioned that questionnaires could be obtained from the author and a half dozen or more inquiries were received as a result of that item.

The number of replies was around 75, but they were from companies whose annual sales total many billions of dollars, whose combined research expenditures run into tens of millions per year and who employ over two thousand research personnel.

THE REPLIES IN SUMMARY

As indicated above, many did not use the questionnaire and few answered all the questions, so let us summarize quickly these replies and then consider in some detail the letters.

	Yes	No
1. Have standards helped the consumer?	18	10
2. Have standards helped the manufacturer?	13	13
3. Have standards harmed the manufacturer?	14	4
4. Should any existing definitions and standards be modified or repealed?	18	4
5. Should additional foods be standardized? (Note: 4 of the 6 affirmative votes contained the proviso "if a need can be shown.")	6	11
6. Have standards affected your research? (Note: Of the 25 affirmative votes, 24 said the effect was to discourage or prevent research.)	25	4

So much for the statistics; now to a summary of the letters.

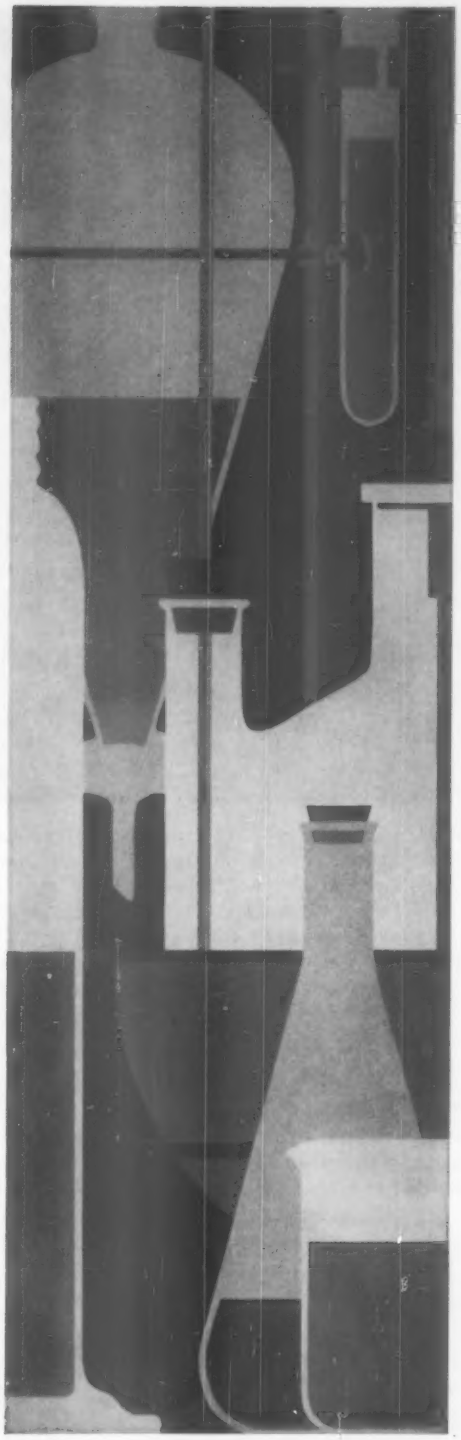
THE LETTERS

The letters indicate that a large segment of the food industry believes Definitions and Standards of Identity have served a useful purpose, but that the time has come to re-evaluate the objectives to be achieved. Many manufacturers ask, "What are the present day objectives of food standards?" Five or possibly six persons suggested this paper emphasize that conditions in 1959 differ greatly from those of 1938 and that the Food and Drug Administrator could aid the industry if he would issue a statement of policy in regard to formulation of additional standards. The great majority of respondents are sincerely interested in the "promotion of honesty and fair dealing in the interests of consumers" and desire to cooperate with the Administrator in attaining that objective. These persons believe very strongly that their concern for the welfare of the consumer is as deep and possibly deeper than that of any government agency. They are certain their progress and growth depends upon being able to serve their public and believe their views on what constitutes fair dealing should be given considerable weight by the Administrator.

The letters indicate that food processors believe the standards provision had two main objectives. The first was to prevent devaluation of foods by substituting an inexpensive ingredient for an expensive one. The dilution of chicken-noodle soup with water and the substitution of sugar for fruit in the manufacture of preserves are examples frequently cited in this regard.

Most respondents stated that standards had been notably successful in achieving this objective. This was the area most frequently cited as having benefited the consumer.

A second purpose of standards, it is believed, was to make it easier for the Food and Drug Administration to control the use of potentially harmful ingredients. It is beside the point whether these were or were not the objectives. The fact remains that many food processors believe these were the reasons for establishing standards. Now that the 1958 food additives amendment requires proof of safety for intended use in either standardized or unstandardized foods one of the foundation blocks supporting the standards provision has been removed. This leads logically to the belief that so long as the use of an additive does not debase the quality of a food its use



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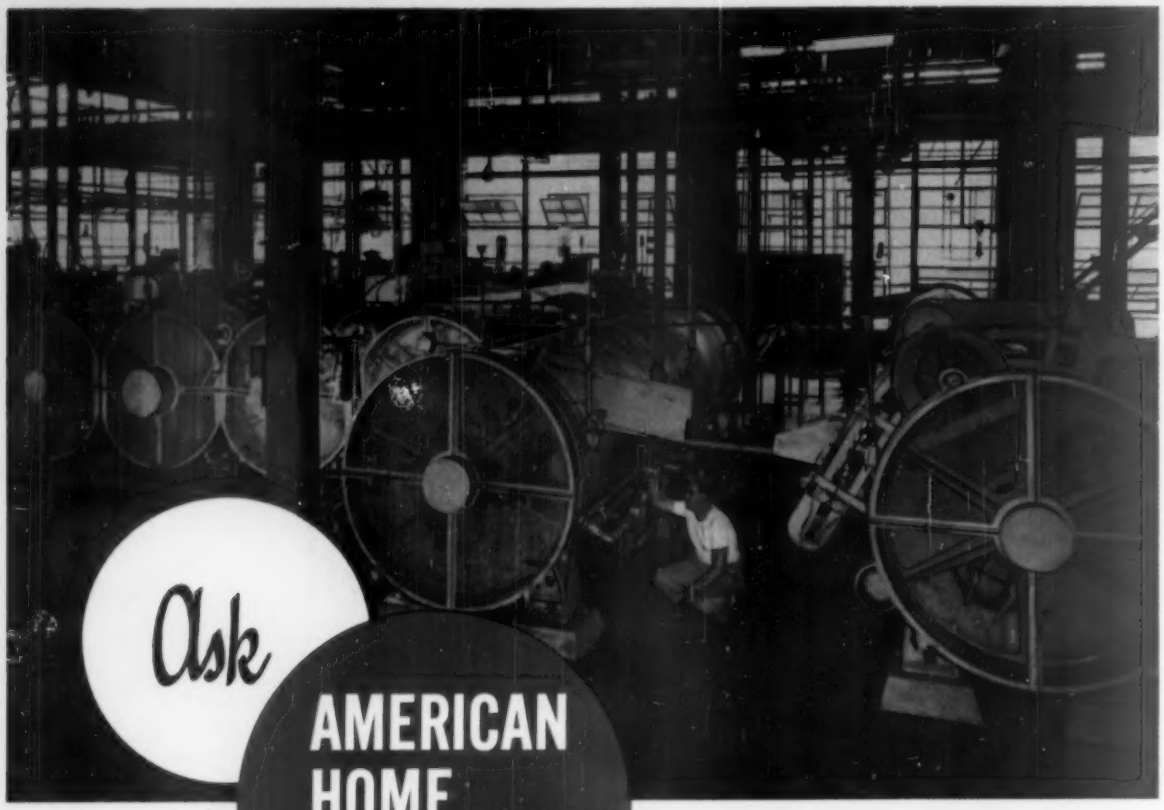

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should be permitted under the terms of the 1958 amendment. Some of the letters echoed Markel's argument (Michael F. Markel, *Food Processing*, July, 1957) that preservation of economic integrity in food does not necessarily require the inclusion of optional ingredients in the standard for that food.

Food additives, as the term is normally used, do not lead to dilution of integrity or economic fraud. If they conceal inferiority or deceive the consumer in any way, such practice is considered adulteration and can be controlled by other sections of the 1938 amendment. Therefore, in the light of the 1958 amendment, why should the use of additives be controlled and restricted by standards? Since 1938, and particularly within the past 10 years, a host of new food products has been developed. Baking mixes, frozen pies, powdered beverage mixes, quick-cooking products, and convenience items of all kinds have been accepted enthusiastically by the housewife. Advances in nutritional knowledge leading to the greater appreciation of the interdependence of many essential nutrients and the relationship between diet and abnormal states of health have stimulated the development of special purpose foods of many types. Much of this advance has been possible only because of the availability of new food additives. But the fullest use of these has been restricted because of existing standards of identity.

Regardless of how much an additive may contribute to the stability, appearance, texture of white bread, or ice cream or any other food for which standards of identity have been established, it cannot be used until it has been officially included in the standards. Although standards can be modified and the Hale amendment adopted in 1954 makes modification relatively simple in some cases, the survey showed most manufacturers were reluctant to request changes for anything but major items. In products like bread there are so many possible additives that at least ninety were included in the bread standards under the classification of optional ingredients. Probably many more could be included, but several respondents said the situation was already so confusing there was no point in adding more additives. Others commented that so many optional ingredients were included in the definition of white bread, bakers had given up trying to put out improved specialty breads. For example, it was stated that even though buttermilk was used as the sole moistening agent in a formula the resulting product could not be called buttermilk bread, because it came under the classification of white bread.

As more and more additives become available the situation becomes increasingly confused. This may not be the fault of the Food and Drug Administration, but many believe it could be cured quickly by appropriate "administrative self-medication" (H. Thomas Austern, *FDC Law J.*, **14**, 214 (1959). Others complained that the housewife was being deprived of better breads than she would have, were standards placed on a different basis. Letter after letter contained variations of the statement, "Since the principal remaining objective of standards is to prevent economic fraud, it is unnecessary for the Administrator to include optional or secondary ingredients. All that is now needed is to establish minimum amounts of expensive ingredients and maximum amounts of the inexpensive ones."

ESSENCE OF THE COMMENTS

The comments considered thus far can be summarized as follows.

The need. Whenever standards are needed to prevent dilution of integrity of foods, industry will support them. Whenever the promotion of honesty and fair dealing in the interest of consumers needs a food standard for its fruition, industry will support that also. The crucial question revolves around the definition of "need." Because of the 1958 amendment, the question of safety need not be considered as a basis for establishing standards, hence there remains only the need to prevent debasement or dilution of integrity. This can be done by placing floors under the expensive basic ingredients and ceilings over the use of inexpensive diluents.

Effect on research. The area where there was most complete agreement was the effect of standards upon research. There can be no question but that promulgation of standards has discouraged research in those areas. A few companies reported a rule exists—"No research money will be spent on any standardized item." Many companies reported research work was discouraged although not prevented on standardized foods. Another very large organization—the largest in its field—reported that executive committee approval had to be obtained before any research was permitted on a standardized food and then it had to be shown that the probable improvements would be so profitable it would be worth the cost of trying to change the standards. Typical quotations on this subject follow. Each comes from a different industry group.

"The existence of Federal Definitions and Standards of Identity for certain foods has had a very pronounced impact upon research in the industry and has at times made it seem impossible for us to plan a successful or promising research program."

"One of the worst things about standards of identity is that changes always have to be major ones before it is worthwhile doing anything about changing the standard and, therefore, until major changes come along all minor improvements are withheld."

"Standards of Identity have certainly held up technological progress in the improvement of many of our food products."

Protection. This writer believes that the food processors represented in this survey, as well as Food and Drug officials, feel a deep obligation to protect the public welfare, but "protection" is defined differently by each group. The food people believe in new development and progress, in making available to the public all improvements possible from advances in a rapidly expanding technology. They believe they

are competent judges of what is good for the public, but they feel their opinions and suggestions are entirely bypassed when Food and Drug policies are established. This leads to frustration and resentment, particularly as they feel the regulatory agency is more concerned with a negative approach and is occupied with a suspicion that any changes proposed by industry are bad unless conclusive proof to the contrary is forthcoming. Although the Administrator has often announced an open door policy many processors still feel their suggestions are not considered impartially and their criticisms arouse resentment. It cannot be doubted that this attitude is unfortunate and efforts should be made to create a freer and more sympathetic consideration of new ideas regardless of their origin.

Standards and food quality and safety. Mention has been made that the reduction in the numbers of cases of dilution of integrity is considered beneficial to the consumer. Some believe in addition that the mere existence of standards has given consumers increased confidence in the quality and safety of foods. Some of these views were as follows:

"Without doubt, Definitions and Standards of Identity have been of great help to the Food and Drug Administration in carrying out its duties of law enforcement. From this standpoint alone . . . consumers have benefited at least indirectly because the job of law enforcement has been made easier and more clear cut."

"I believe that our Company and many others have been helped by these standards, at least by some of them, in that their existence has made for fairer competition and greater confidence of the public in our industry's products."

"We feel there is advantage to the public and to industry in food standards."

"Standards tend not only to upgrade the products of the bucketshop operator, which is good, but to stabilize if not down-grade the products of the better and more progressive manufacturer, which is bad. . . . Some means must be found to permit manufacturers to make a better product than the standards provide, if they wish to do so."

"I think all of us will agree that the experience of the food industry in the area of non-standardized foods clearly shows the downgrading effects of unbridled price competition on basic quality of such foods, with a resulting loss of consumer respect for the class of foods involved and a deterioration of the industry. This can happen particularly where there is lack of statesmanship on the part of seasoned food manufacturers who should know better, who in the face of such price competition in the form of low quality merchandise allow themselves to be led down the primrose path and likewise degrade their own standard products so as to be price competitive. There is little question but that the Definitions and Standards for Foods help in some measure to prevent this sequence of events."

A few persons declined to comment because they believe any public criticism of standards will be interpreted by consumer groups as evidence that the food industry is indifferent or neglectful of its public responsibilities. One or two feel it unwise to criticize any actions of the Food and Drug Administration for fear of arousing the displeasure of that agency.

GENERAL PHILOSOPHY OF THE INDUSTRY

The general philosophy of the industry as gleaned from all the comments appears to be as follows:

1. Ethical food manufacturers are sensitive and responsive to public opinion. They feel an obligation to produce foods free from impure or unwholesome products and to make foods which they believe the customer wants.
2. They believe they are better informed of consumer desires and needs than any other group and, assuming safety of ingredients has been achieved, the housewife should be the arbiter as to what products should be manufactured.
3. They believe in informative labeling and freedom to make improvements in a wide variety of products.
4. They believe recipe standards are a disservice to consumers because they delay or prevent improvement, place a premium on mediocrity and deprive the consumer of freedom of choice.

Thus, as in any important question, there is a wide range of ideas and much of the area is confusing. What, if anything, can the Institute of Food Technologists contribute to the problem? That is for you to decide, but it is suggested the following might be guideposts along the journey to a solution of these problems.

1. The food standards law is on the books and it will not be repealed or even modified substantially without the approval and backing of the Food and Drug Administration.
2. If any change is to be made within a reasonable period of time it is likely to be made through the adoption by the Administrator of constructive, reasonable suggestions from manufacturers as well as consumer groups.
3. The food industry must not forget that the Administrator is under constant pressure from many groups to modify or change the rules. If he yielded to the demands of certain groups, we in the food industry would be in a very sorry situation.

Finally, as specific objectives of the Institute of Food Technologists, the following questions were proposed for discussion:

Should we

(1) encourage the Food Additives Committee to continue active and arrange additional programs in this field at future IFT meetings?

(2) attempt to establish a list of minimum objectives which the standards provision should achieve?

(3) appoint a group to maintain contact

with the Food and Drug Administrator and bring back to our members an explanation of the major problems confronting FDA? This assumes the Administrator would be willing to discuss these problems with us. This group might eventually bring up for consideration whether it is either advisable or possible for the IFT to take a position on future legislative matters that may arise in the field of food law.

(4) make a formal effort to improve our public relations? Might we form a panel of food technologists who would be available for consultation by editors writing on food and nutrition subjects? Possibly as a start, a group of IFT members might discuss with one or two editors in New York whether these editors have any desire for a panel of consultants in the field of food technology.

Preparation of Pectin from Raw Papaya (Carica Papaya) by Aluminium Chloride Precipitation Method

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Central Food Technological Research Institute, Mysore, India

(Manuscript received March 27, 1959)

ALTHOUGH PRECIPITATION of pectins by aluminium salts has been known since 1924 *(6)*, the published literature on this subject has been rather limited. In a recent paper *(7)*, Joslyn and De Luca described the formation and properties of aluminium pectinates and found aluminium chloride to be much more efficient than aluminium sulphate and potassium alum, as precipitating agent for pectin. In another paper *(3)* they described the conditions affecting the recovery of pectin from orange peel extracts as aluminium pectinate.

Since raw materials like citrus peels and apple pomace used in other countries for the preparation of pectin are not available in India in any substantial quantities, indigenous fruits like papaya *(carica papaya)* and jack fruit *(Artocarpus integrifolia)*, widely available in the country, have been tried for the preparation of pectin, using the conventional alcohol precipitation method *(4, 5)*. In the present paper results of investigations carried on the preparation of pectin from raw papaya by aluminium chloride precipitation method are reported.

MATERIALS AND METHODS

Raw papaya fruits (local Mysore variety) were picked from the plants grown on the Institute premises at a stage of maturity of about 3 months after setting of the fruits. They were full sized and had completely green skin and whitish pulp and seeds inside. The fruits were washed, cut with stainless steel knives and minced in a meat mincing machine using 18-mesh sieve. In some experiments peeled fruit and peel alone were used. Minced pulp was washed twice with 1¼ times the weight of water, with a holding time of 5 minutes, and the soluble solids were pressed out with a basket press. The pressed pulp was extracted by procedures described in Table 1. The pH of the mixture ranged from 2.8 to 3.0.

After extraction, the liquid was pressed out in basket press. The extracts were cooled immediately and clarified by cen-

TABLE 1

Effect of different methods of extraction on the yield and quality of pectin from whole minced raw papaya

Treatment	Yield of pectin	Jelly grade of pectin	Moisture	Ash	Aluminium
A. At 80° C.	%		%	%	%
1. Single extraction of raw minced papaya for ½ hour with 4 times 0.02 N HCl	0.17	170	9.68	1.37	0.233
2. As above but extracted for 3 hours	0.54	180	11.32	1.11	0.052
3. Four separate extractions each of ½ hr. duration using 1½, 1, 1, and 1 times 0.02 N HCl each time respectively	0.57	230	10.57	1.53	0.150
B. At 100° C.					
4. As 1 under (A) above	0.60	219	8.93	1.77	0.260
5. As 2 under (A) above	0.65	194	10.15	0.95	0.090
6. As 3 under (A) above	0.86	210	10.40	1.22	0.008

trifuging. The extract adjusted to pH 3.5 was precipitated with 1M $AlCl_3$ solution at pH 4.0. The aluminium pectinate was strained through mull cloth and most of the water was removed by pressing. The precipitate was purified by washing with alcohol containing HCl and pectin was obtained by drying at 37° C. for about 5 hours and passing through a 100-mesh sieve. For comparison, pectin was also prepared by the conventional alcohol precipitation method.

Pectin samples ground to pass through a 100-mesh sieve were analysed for moisture, total ash, acid insoluble ash, alkalinity of ash, aluminium, equivalent weight, methoxyl content, anhydro-uronic acid, and jelly grade. Moisture was determined by drying at 70° C. for 16 hours. Total ash, acid insoluble ash, alkalinity of ash and aluminium were estimated by A.O.A.C. methods used for plant materials. Equivalent weight was determined *(8)* by titrating slowly 0.5 g. of pectin to which 100 ml. of CO_2 free distilled water, 1 g. of NaCl and 6 drops of phenol red indicator were added, with 0.1 N NaOH until the indicator changed (pH 7.5). The value of equivalent weight was calculated from the equation:

$$\text{Eq. Wt.} = \frac{1000 \times \text{wt. of sample (g.)}}{N \times \text{Volume of alkali (ml.)}}$$

For the estimation of methoxyl content, the neutral solution titrated for equivalent weight was allowed to stand for 30 minutes at room temperature in a stoppered flask after shaking thoroughly with 25 ml. of 0.25 N NaOH. After adding 25 ml. of 0.25 N HCl it was titrated with 0.1 N NaOH to the same end point as for equivalent weight determination. Methoxyl content was calculated from the equation:

$$\% \text{ MeO} = \frac{N \times \text{Vol. of alkali (ml.)} \times 3.1}{\text{Wt. of sample (g.)}}$$

Anhydrouronic acid was calculated using the following two equations *(8)*:

$$Z = \frac{\text{Wt. of sample (mg.)}}{\text{m.e. alkali for free acid} + \text{m.e. alkali for saponification} + \text{m.e. titratable ash}} \quad (1)$$

$$\text{Per cent anhydrouronic acid} = \frac{176 \times 100}{Z} \quad (2)$$

Jelly grade was determined by preparing 65% sugar jellies employing a constant weight (50 g.) of sugar, varying proportions of pectin (as 1% solution) and such quantities of 10% citric acid solution as to get a pH within the range 2.9 to 3.1 which was found in preliminary experiments to be the optimum for best results. Total weight of each mix was kept constant (100 g.) in a series of jellies from the same sample, distilled water being added to make up the difference. Cooking was done on an electric hot-plate to a final weight of 77 g. in each case and the jellies obtained were compared after 20 hours with those prepared under identical conditions from a standard pectin sample (200 grade Genu citrus pectin) using finger test for comparison.

RESULTS AND DISCUSSION

Composition of leached solids in the two water washings. Determination of the composition of leached solids in the 2 water washings of minced papaya showed that about 6% of soluble solids are leached in 2 washings out of total soluble solids content of 6.5%. Loss of pectin in leached water is practically negligible.

Extraction experiments. In order to find a suitable extraction procedure, different extraction methods were tried, as given in Table 1. It will be seen that yield and jelly grade of pectin samples prepared after extraction with 0.02 N HCl at 80° C. for half-an-hour or 3 hours were lower than corresponding batches at 100° C. Four separate extractions, each of half-an-hour duration using 1½, 1, 1 and 1 times 0.02 N HCl at 100° C. each time, respectively, resulted in higher yield than in the case of a comparable sample at 80° C.

Since there was not a very marked difference in the jelly grades of these 2 batches, the procedure of extracting at 100° C. with 0.02 N HCl four times separately was considered to be the best.

Yield and quality of pectin prepared from individual extracts. Analytical data regarding yield and quality of pectin prepared separately from each of the 4 extracts are given in Table 2. It will be seen that yield is maximum in the second and third extracts. The rate of extraction of pectin appears to be slow during first extraction and after most of the pectic substances have been extracted in the second and third extractions, it again decreases. Jelly grade of pectin goes on increasing up to the third extraction, after which the value goes down—probably due to heat damage after repeated extractions at boiling temperature. Total ash and acid insoluble ash continue to decrease during each extraction. Equivalent weight and methoxyl content of the pectin also goes on decreasing, due to the de-esterification caused by the acid extraction. Anhydrouronic acid content is the maximum in the first extract.

TABLE 2

Yield and quality of pectin prepared from individual extracts

	First extract	Second extract	Third extract	Fourth extract
Yield % (on fresh fruit basis)	0.22	0.29	0.29	0.21[1]
Moisture %	11.88	10.74	9.89	9.73
Total Ash %	8.34	3.88	2.81	2.60
Acid insoluble ash %	1.51	0.35	0.12	0.10
Jelly grade	179	192	250	167
Equivalent weight[2]	893	843	724	605
Methoxyl content %[2]	9.4	8.1	7.0	6.7
Anhydro-uronic acid %[2]	78.25	70.65	67.63	69.28

[1] Pectin (as calcium pectate) in the residual pulp = 0.0053%.
[2] Moisture and ash free basis of pectin.
Moisture in fresh fruit = 92.0%.

Quality of pectin prepared from stored extract. Under commercial conditions it may become necessary to store the extract for some days before it is precipitated. It was therefore of interest to study the effect of storage of extract on the quality of pectin. Table 3 gives the results of these tests. Storage of extract without added SO_2 for 4 days at 2–5° C. or with 350 p.p.m. SO_2 for 4 days at room temperature (20–25° C.) does not seem to affect the jelly grade of the pectin. Storage at room temperature with 350 or 700 p.p.m. SO_2 for 8 to 15 days lowers the jelly grade slightly. Burroughs *et al. (2)* reported that SO_2 in all concentrations from 250 to 1500 p.p.m. had a preservative effect on the apple pomace, and the loss in jelly quality of the pomace stored with SO_2 was found to be slight up to 7 days but became considerable after 13 days *(2)*. Methoxyl content of the pectins prepared from extracts stored up to 15 days at room temperature with added SO_2 or at 2–5° C. without SO_2 seems to remain unaffected.

TABLE 3

Quality of pectin during storage of the pectin extract

Treatments	Storage temperature	No. of days	Moisture	Total ash	Jelly grade	Moisture and ash free basis		
						Equivalent weight	Methoxyl content	Anhydro-uronic acid
	°C.	....	%	%			%	%
1. Control			11.15	5.42	208	575	8.9	80.6
2. Without preservatives	2–5	4	11.00	6.00	200	486	7.4	80.0
3. With 350 p.p.m. SO_2	20–25	4	13.60	6.61	208	445	7.9	85.5
4. With 350 p.p.m. SO_2	20–25	8	10.95	7.25	180	477	7.8	82.3
5. With 350 p.p.m. SO_2	20–25	12	11.24	7.60	180	473	7.9	83.2
6. With 700 p.p.m. of SO_2	20–25	8	12.01	7.28	180	499	8.3	83.6
7. With 700 p.p.m. of SO_2	20–25	15	12.78	6.30	180	473	7.8	85.6

Purification of pectin. Aluminium pectinate contains about 12–15% total ash and 4–5% aluminium and before it can be marketed, it has to be purified. Washing the wet aluminium pectinate with acidified alcohol reduces the ash content considerably. In earlier experiments (Tables 2, 3, 4) first washing was given with 40% alcohol containing 3.5% HCl, second with 95% alcohol containing 3.5% HCl and subsequent 2 washings with 95% alcohol. The pectin purified by this procedure contained 3–7% ash and 0.2–0.3% aluminium. In subsequent experiments, however, 5 washings were given with (i) 40% alcohol + 5% HCl (calculated on the basis of alcohol added + water in the precipitate); (ii) 50% alcohol + 5% HCl; (iii) 60% alcohol; (iv) 70% alcohol; (v) 95% alcohol. Ash and aluminium contents of pectin samples prepared by this procedure were 0.95–1.77% and 0.008 to 0.260% respectively (Table 1). Assuming the addition of 1% pectin in jams, jellies and marmalades, the aluminium content in the final products will be of the order of 0.8–26 p.p.m. which is not considered high for these products.

Yield and quality of pectin. In Table 4, data regarding yield and quality of pectin prepared from peeled papaya as affected by different concentrations of aluminium chloride are given. The yield of pectin from peel only was 0.09% expressed on the basis of whole fruit or 0.45% of peels alone. Although the jelly grade of this pectin is lower (167) than that of peeled fruit (227), the process of peeling is time consuming and expensive and it is desirable to avoid it. Moreover the percentage of peel in the whole fruit is about 18–20% which brings in only slight reduction in jelly grade of pectin prepared from the whole fruit. Most of the green colour of the skin is removed during washing of the precipitate with ethanol and the colour of the pectin prepared from the whole fruit is almost like that prepared from peeled fruit.

Aluminium chloride concentrations of 0.25, 0.30, 0.40, 0.50 and 0.75% of the pectin extracts containing about 0.5% pectin were tried and 0.50% was found to give the maximum yield. Concentration of 0.75% was considered too high as it did not increase the yield above that of 0.5% concentration.

Comparison of precipitation at room temperature and 70° C. with 0.5% $AlCl_3$ shows that yield of pectin is lower in case of precipitation at 70° C., while the quality is not much affected. De Luca and Joslyn *(3)* reported higher yields of aluminium pectinate when precipitation was carried at 70° C. We have observed lower yield at 70° C. consistently in 4 separate batches of pectin, preparing about 5–6 oz. of pectin from 35–40 lbs. of fruit in each batch. It may, however, be mentioned that in case of De Luca and Joslyn's experiments, the results are based on about 2 lb. (1 kilo) of fresh orange peel handled at a time. Another factor worth mentioning is that difference in the degree of esterification of pectin from papaya and citrus peels may affect the yield of pectin prepared by aluminium chloride precipitation method *(7)*.

For comparison, analysis of commercial Genu citrus pectin, Type D 200, slow set, obtained from Denmark is given. It showed that papaya pectin compares well with it in quality.

Comparison of the $AlCl_3$ precipitation and the alcohol precipitation methods. The aluminium chloride precipitation method has the following advantages when compared with the alcohol precipitation method:

(a) Quality of pectin in the $AlCl_3$ precipitation method is superior to that prepared by the alcohol

TABLE 4

Yield and quality of pectin prepared from peeled raw papaya as affected by different concentrations of $AlCl_3$

Treatment	Pectin yield from raw fruit	Moisture	Total ash	Jelly grade	Moisture and ash free basis	
					Methoxyl content	Anhydro-uronic acid content
	%	%	%		%	%
1. Conventional alcohol precipitation method	0.72	8.58	4.79	227	7.5	66.8
2. Precipitated with 0.25% $AlCl_3$ and washed with acidified alcohol	0.45	10.21	1.58	227	7.7	75.8
3. As above but precipitated with 0.3% $AlCl_3$	0.66	.....	.....	.....	....	.....
4. As above but precipitated with 0.4% $AlCl_3$	0.68	.....	.....	.....	....	.....
5. As above but precipitated with 0.5% $AlCl_3$	0.71	12.01	2.91	227	7.8	77.7
6. As above but precipitated with 0.75% $AlCl_3$	0.71	12.60	5.99	219	9.1	76.7
7. As above but precipitated with 0.5% $AlCl_3$ at 70° C.	0.62	10.06	4.93	219	8.1	74.4
8. Commercial Genu citrus pectin D200° (Control sample)	.....	8.56	1.71	200	4.7	57.5

Moisture of raw papayas = 92.0%.
Calcium pectate in raw papaya = 0.85%.

precipitation method. In Table 4, anhydrouronic acid content of pectin prepared by the $AlCl_3$ precipitation method is more than that of the alcohol precipitation method, showing thereby that pectin prepared by this method is contaminated less by non-uronide matter *(7)*.

(b) There is a considerable saving in the requirement of ethyl alcohol in using the $AlCl_3$ precipitation method. In a typical experiment, for the preparation of one pound of pectin, 8.5 litres of 95% ethyl alcohol was required in the case of the $AlCl_3$ precipitation method as against 39 litres in the case of the alcohol precipitation method.

(c) The expensive procedure of vacuum concentration before precipitation with ethyl alcohol is not necessary in case of the $AlCl_3$ precipitation method.

SUMMARY

An investigation on the preparation of pectin from raw papaya by aluminuim chloride precipitation has shown that concentration of 0.5% aluminium chloride in the cold at a pH of 3.8 to 4.0 gives the maximum yield of pectin.

Optimum conditions for extraction and purification have been worked out.

Precipitation at 70° C. lowers the yield of pectin, though the quality of pectin is not much affected.

Jelly grade of pectin prepared from peel of raw papaya (18–20% peel in the fruit) is lower than that prepared from peeled fruit. However, jelly grade of pectin prepared from whole fruit is only slightly lower than that from peeled fruit. Peeling of the fruit is therefore not considered necessary.

Yield of pectin prepared from second and third extracts is maximum. Jelly grade of pectin goes on increasing up to three extractions, after which it starts decreasing.

Storage of extract without added SO_2 for 4 days at 2–5° C. or with SO_2 for four days at room temperature (20–25° C.) does not seem to affect the jelly grade of the pectin. Methoxyl content of the pectins prepared from extracts stored up to 15 days with the addition of SO_2 at room temperature or without SO_2 at 2–5° C. seems to remain unaffected.

Merits of $AlCl_3$ precipitation method as compared to the alcohol precipitation method are described.

Most of the soluble solids of papaya mince are leached out by two cold water extractions of 5 minutes each. Loss of pectin in leached water is practically negligible.

Acknowledgment

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LITERATURE CITED

1. Bhatia, B. S., Siddappa, G. S., and Lal, G. Preparation of pectin, pectin extract and syrup from jack fruit rind. *Indian J. Agr. Sci.*, **28**. Accepted for publication (1958).
2. Burroughs, L. F., Kieser, M. E., Pollard, A., and Steadman, J. The treatment of apple pomace prior to drying for subsequent pectin extraction. *Fruit Products J.*, **24** (1), 4 (1944).
3. De Luca, G., and Joslyn, M. A. The recovery of pectin from orange peel extracts as aluminium pectinate. *Food Technol.*, **11**, 137–141 (1957).
4. Jain, N. L., and Lal, G. Preparation of high grade pectins from papaya, jack fruit and wood-apple. *Bull.* C.F.T.-R.I., **4**, 287 (1955).
5. Jain, N. L., and Lal, G. Some studies in the utilization of jack fruit wastes as a source of pectin. *Indian J. Hort.*, **14**, 213–222 (1957).
6. Jameson, E., Wilson, C. P., and Taylor, F. M. (to California Fruit Growers Exchange). U. S. Patent No. 1, 497,884, June 17, 1924.
7. Joslyn, M. A., and De Luca, G. Formation and properties of aluminium pectinates. *J. Colloid. Sci.*, **12**, 108–130 (1957).
8. Owens, H. S., *et al.* Methods used at Western Regional Research Laboratory for extractions and analysis of pectic materials. AIC-340, June 1952. Bureau of Agricultural & Industrial Chemistry, Agricultural Research Administration, U.S.D.A.

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Effect of Pretreatment and Type of Packaging Material on Quality of Frozen Fried Chicken[a,b]

(Manuscript received September 3, 1957)

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THE AMOUNT AND VARIETY of precooked frozen foods available on the market has increased greatly in the past few years. Frozen precooked chicken pies have attained great popularity, but frozen fried chicken has been marketed only to a limited extent because off-flavors have occurred in the product.

At the time when this study was initiated, only one report had been published on frozen fried chicken. In 1954, Hanson *(2)* stated that off-flavors developed more rapidly in frozen fried chicken than in uncooked frozen fryers. However, she reported that little or no flavor change occurred until the completely precooked birds had been stored for 6 months at 0° F. Flavor changes occurred in the meat, she stated further, rather than in the skin and were therefore not related to rancidity development in the cooking fat taken up in the dredging material during precooking.

The main objectives of the research which the present article reports in part were to investigate the flavor, tenderness, and juiciness of frozen fried chicken and to explore possible methods for improving the quality and increasing the shelf life of a precooked product. The study reported herewith was designed to determine the effect of several variables on the stability of frozen fried chicken. The influence of the degree of precooking was tested to determine whether or not the flavor of partially precooked frozen broilers was approximately the same as that of a completely cooked frozen product. Three types of packaging material were used, and the flavor of both the meat and the skin was evaluated after storage at 0° F. for 0, 5, 10 and 15 weeks.

Since weight losses during precooking are of concern to processors and losses during reheating are important to consumers, data were obtained to calculate weight losses during the various steps in processing, storage, and final preparation of the broilers for consumption.

EXPERIMENTAL PROCEDURE

New Hampshire broilers, pullets and cockerels, 13 weeks of age and of similar genetic history were obtained from the Iowa State University Poultry Farm. All birds had been fed a typical finishing ration for broilers that contained neither fish meal nor cod liver oil. The 108 broilers used in the experiment were killed by slitting the jugular vein and allowed to bleed freely for 1 minute. After scalding for 30 seconds in water (120° F. ± 2° F.), birds were machine picked, eviscerated and ice-slush cooled for 24 hours.

Since one of the objectives of this study was to determine the effect of the degree of precooking on the quality of frozen broilers, preliminary tests were conducted to measure internal temperatures of broilers during deep-fat frying. In these tests, thermocouples were inserted into the thigh, leg and breast pieces of chicken and the temperatures during cooking were recorded on a recording potentiometer.[f] Then a complete cooking for 10 minutes to an internal temperature of approximately 195° F. and a partial cooking for 3 minutes to 80–90° F. were selected for investigation. Only the thighs, breasts and legs of broilers were given one of the following treatments prior to packaging and freezing: (1) floured and partially cooked in deep-fat for 3 minutes (80–90° F.) or (2) floured and completely cooked in deep-fat for 10 minutes (190–195° F.). Some of the broilers were not precooked and were used as controls.

Precooking. In preparation for deep-fat frying, broiler parts were weighed, dipped in homogenized milk, drained for 5 seconds and then coated with a flour mixture consisting of 2 parts all-purpose wheat flour and 1 part potato flour. Broiler parts were weighed again. Then they were deep-fat fried in a covered, 5 quart, thermostatically controlled, electric deep-fat fryer.[g] The thermostat on the fryer was set at 375° F. and 5 pints of peanut oil were used. Peanut oil was selected for deep-fat frying because of its high smoke point *(6)* and because it imparted little or no flavor to the fried product. A company that manufactures peanut oil stated that after the usual refining processes, including deodorization, peanut oil has a smoke point in excess of 400° F., free fatty acids below .05%, and has a bland, pleasing flavor. After frying, samples were allowed to drain for 1 minute before weighing.

Packaging. The untreated broilers and those precooked 3 or 10 minutes were randomly divided into 3 groups for packaging in Cryovac, polyethylene or aluminum foil. Thirty-six broilers, 12 broilers from each of the 3 treatments described above, were packaged in Cryovac bags. After a broiler was placed in a Cryovac bag, the air was evacuated and the package was immersed in water (180°F.) for 15 seconds to shrink the film tightly around the bird. Also, 36 broilers (12 from each treatment) were packaged in polyethylene bags (0.00125 in.) and

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[f] Brown-Electronik Potentiometer, Brown Instruments Div., Philadelphia, Pa. (Range −30° to 579° F.).

[g] Sunbeam, C. F. 1500-watt deep-fat fryer.

36 were wrapped, drugstore style, in aluminum freezer foil (0.0015 in.).

Storage. All packaged broilers were weighed and then frozen at −30° F. for 24 hours. The interval between frying and freezing was approximately 2 hours. The 81 samples for evaluation at the 5, 10 and 15 week storage periods were transferred to the 0° F. room for storage. Since 3 samples were tested and evaluated by the taste panel each day for 9 days, 27 broilers (3 treatments x 3 packaging materials x 3 replicates) for evaluation at 0° storage were held at −30° F. This test pattern was repeated at each storage period.

Thawing. Broiler parts were thawed in the package in a refrigerator (33° F. ± 2° F.) for 24 hours. Then they were placed in a constant temperature room (72° F. ± 2° F.) for an additional 3 hours. One-half hour before reheating, the samples were removed from the package, placed in a glass funnel and allowed to drain into a graduate cylinder. Amount of drip was recorded and pH of the drip was determined.

Final cooking. After the frozen fried chicken was thawed, the precooked samples were reheated in peanut oil at 350° F. until they had reached an internal temperature of approximately 185° F. As determined in preliminary experiments in which thermocouples and a recording potentiometer were used *(5)*, the time required to reach this temperature was 3 to 4 minutes for birds precooked 10 minutes and 5 to 6 minutes for samples precooked 3 minutes. The thawed untreated control broilers were dipped in homogenized milk, coated with the wheat and potato flour mixture and deep-fat fried in peanut oil (at 375° F.) for 10 minutes until the surface was a medium brown.

Taste panel evaluation. A split plot design was used that provided for the evaluation of broilers from each of the 3 treatments but from only one packaging material at any daily evaluation session during each testing period. Since there were 3 replicates of each of the 3 treatments for each of the 3 packaging materials, broilers were evaluated from 9 consecutive days at each of the 0, 5, 10 and 15 week storage periods. To minimize changes that might occur during the 9 days at 0° F., a sufficient number of broilers for evaluation were transferred from 0° F. to −30° F. storage at the beginning of each judging period on the assumption that less change would occur at −30° F. than at 0° F.

Broiler samples were evaluated by 5 carefully selected and trained taste panel members in specially designed, individual taste panel booths. Red fluorescent lights were used during the judging to mask any color differences between samples that might bias a judge's evaluation of flavor.

Coded samples were served hot in heated porcelain dishes. Each panel member scored the same part of the broiler at each evaluation session for meat flavor, skin flavor, tenderness and juiciness on a scale of 10 to 0. Off-flavors of the skin and of the ment were scored on a 0 to 10 scale with 0 denoting no off-flavor.

RESULTS AND DISCUSSION

Weight changes. In the processing of fried chicken prior to freezing, there is the possibility of a weight gain during dredging or coating with flour, followed by a weight loss during precooking. Increases in weight of the raw chicken parts, after applying the coating of milk and flour, averaged approximately 7%. A comparison of the weights obtained immediately after cooking broilers with the raw weights before dredging indicated there was an average net gain of 3% for samples cooked 3 minutes and net losses of from 5 to 10% for those cooked 10 minutes. During the cooling period prior to packaging there was an additional weight loss of 3% for broilers cooked 10 minutes and 1.5% for those cooked 3 minutes. Hanson *(2)* reported that the gain in weight of halves of medium weight fryers averaged approximately 4% following dredging in wheat and potato flour and a net loss of 17% for the fried birds.

Regardless of pretreatment, broilers wrapped in foil showed practically no changes in weight throughout the 15 weeks of storage at 0° F. In general, the weight changes were minimal during storage of the broilers packaged in polyethylene or Cryovac.

Only untreated broilers lost any weight in the form of drip during thawing. The largest amount of weight lost in drip averaged 1.0 to 2.5% for broilers packaged in polyethylene. About the same amount was gained during frozen storage. The least amount of weight was lost by samples wrapped in aluminum foil (0.2 to 1.0%) and these samples did not gain weight during frozen storage. Length of storage under the conditions in this study appeared to have no effect on the quantity of drip lost from untreated frozen broilers. The pH values of the drip, regardless of packaging material or storage time, ranged from pH 6.0 to 6.5. Sair and Cook *(3)* reported pH values of 6.05 to 6.35 for fluid exuded from the tissues of frozen untreated chickens.

During the reheating of the thawed precooked broilers, there was an average loss in weight of 23% for samples precooked 3 minutes and 14% for those precooked 10 minutes. A comparison of original raw weights before freezing and precooking with final cooked weights (i.e., when broilers were ready-to-eat) revealed that precooked broilers decreased 26% in weight, whereas the untreated chickens decreased only 16% in weight. Total weight losses of 26% for precooked frozen chicken indicates the possibility that these samples would be less juicy than the untreated broilers. Judges' scores for juiciness in most instances were lowest for broilers precooked 10 minutes, those precooked 3 minutes were intermediate, and untreated samples were the juiciest (Figure 1). Statistical analysis of judges' scores for juiciness revealed that the effects of both storage and amount of precooking were highly significant.

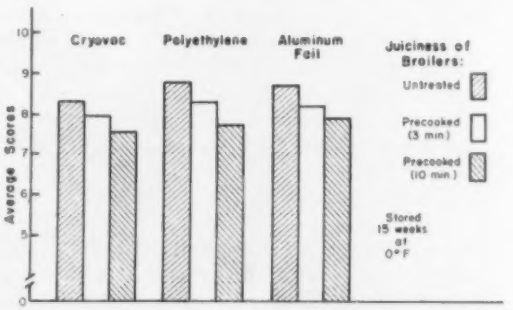

Figure 1. Effect of pretreatment on juiciness of frozen broilers.

Flavor changes. Analysis of variance of the flavor scores for the 3 treatments indicated that the effect of packaging was not significant (Table 1). Therefore, the flavor scores for all broilers in the 3 packaging materials were combined and averaged for each treatment at each storage period. The graphic presenta-

TABLE 1

Analysis of variance of flavor scores for frozen untreated and precooked broilers

Source of variation	Degrees of freedom	Mean squares			
		Flavor		Off-flavor	
		Meat	Skin	Meat	Skin
Replications	2	0.406	0.240	0.460	1.368
Storage (S)	3	6.263[1]	3.359[2]	5.936[1]	6.068[2]
Packaging (P)	2	0.040	0.551	0.310	0.458
P X S	6	0.168	0.230	0.105	0.388
Error (a)	22	0.176	0.485	0.330	0.520
Treatments (T)	2	1.193[3]	5.691[1]	1.716[2]	5.664[1]
3 vs. 10 min		0.813[5]	2.358[2]	1.108[4]	3.071[2]
T vs. control		3.013[3]	9.024[1]	2.325[3]	8.256[1]
S X T	6	0.217	0.335	0.225	0.346
P X T	4	0.193	0.256	0.327	0.424
P X S X T	12	0.165	0.097	0.082	0.102
Error (b)	48	0.266	0.256	0.190	0.246
Total	107				

[1] p = 0.1%; [2] p = 0.5%; [3] p = 1%; [4] p = 2.5%; [5] p = 10% level of significance.

tion of the flavor scores (Figure 2) shows the extent to which precooking lowered the flavor of the meat and of the skin of the broilers. Regardless of treatment, as the storage time increased the flavor scores of all broilers decreased. Also, the differences between the untreated and precooked samples were more apparent. Analysis of variance revealed that the effects of treatment and of storage time on meat flavor and on skin flavor were highly significant (Table 1). The degradation in flavor of both the meat and the skin of precooked broilers is in agreement with results obtained by Hanson *et al. (3)*. They reported that flavor changes were detected in the meat and in the skin and coating, indicating that flavor instability is as serious in the meat as in the skin and outer coating.

All broilers increased in degree of off-flavor with an increase in storage time regardless of packaging material (Figure 3). Analysis of variance indicated that the effect of storage and of treatment on off-flavor of both the meat and the skin of the broilers was highly significant (Table 1). After 15 weeks of storage, untreated broilers had less off-flavor than the precooked samples. Broilers that had been precooked 3 minutes had more off-flavor than those precooked 10 minutes. One possible explanation might be that during the 3 minutes of precooking to a temperature of 80–90° F. an enzyme system was activated or a chemical compound released that altered the characteristic flavor of the meat. In the poultry precooked for 10 minutes to 190°–195° F. the enzymes might have been inactivated or the compound dissipated. Also flavor degradation that occurred in the meat as well as in the skin of the precooked broilers suggests that the cooking oil may not be the only causative factor.

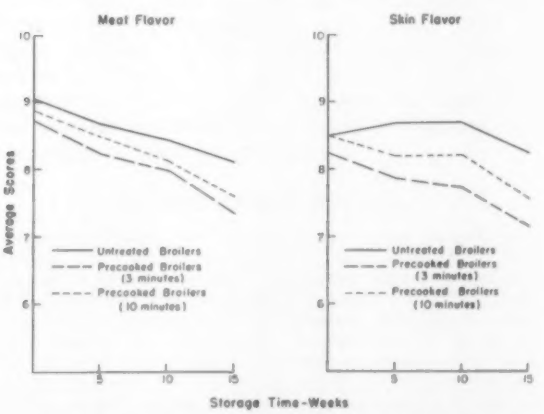

Figure 2. Changes in meat flavor and in skin flavor of precooked and untreated frozen broilers stored at 0° F. (Each experimental point represents an average of 5 judges' scores for 9 replicates.)

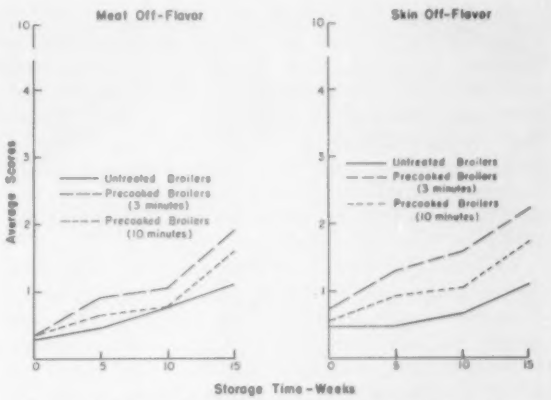

Figure 3. Effect of pretreatment on flavor stability of frozen broilers stored at 0° F. (Each experimental point represents an average of 5 judges' scores for 9 replicates.)

In general, the differences in flavor between untreated broilers and precooked broilers were greater than the differences between broilers precooked for 3 minutes and those precooked for 10 minutes. These data indicate that cooking prior to freezing accelerates a flavor change in meat. Usually difference in flavor between untreated and precooked samples stored 4 months at 0° F. may be ascribed to a "warmed-over" or "stale" flavor characteristic of cooked foods that have been stored in the refrigerator and then heated again for serving. This flavor is not objectionable but detracts from the "fresh" flavor characteristic of the control, i.e. the birds that were not cooked prior to freezing. However, although all samples were frozen within two hours after precooking, frequently the judges remarked about an objectionable "fishy" flavor in some precooked samples that was quite undesirable. As yet no cause or explanation has been found for this flavor. In an article on prevention of bone darkening in frozen chicken, Woodroof *(7)* stated that heating legs of fryers for 10 minutes in oil before freezing prevented bone discoloration but impaired the flavor. Also, Gilpin *et al. (1)*, in a study on the quality of canned chicken, found that chicken fried before canning changed more during storage than chicken packed raw.

Rancidity is often a problem in frozen poultry. No rancid flavors were detected in the present study but the precooked samples were stored only 4 months at

0° F. Hanson *et al. (3)* reported rancidity was detected in precooked samples held 9 months at 0° F. Since flavor changes in frozen fried chicken are fairly rapid, the product should be stored at low temperatures (0° F. or lower) and the storage time should be as short as possible (4 to 6 months).

SUMMARY

Thighs, legs and breasts of broilers, untreated or precooked for 3 or for 10 minutes, were packaged in Cryovac, polyethylene or aluminum foil and stored at 0° F. After storage for 0, 5, 10 and 15 weeks, samples were removed for evaluation. Weight changes that occurred during pretreatment, storage, thawing and final cooking were determined. A taste panel of 5 members scored the broilers for meat flavor, skin flavor, tenderness, juiciness, meat off-flavor and skin off-flavor.

Increases in weight of raw chicken parts, after applying the coating of milk and flour, averaged 7%. During precooking, samples cooked 3 minutes lost some weight but had a net gain of 3%. However, samples precooked 10 minutes had a net loss of approximately 10%. In general, for either the control or the precooked broilers, packaged in aluminum foil, Cryovac or polyethylene, there was little or no change in weight throughout storage. Only the untreated broilers exhibited drip losses during thawing and there was no relationship between the quantity of drip, length of storage, type of packaging material or pH of the drip.

During the reheating of the thawed precooked broilers, there was an average loss in weight of 23% for samples precooked 3 minutes and 14% for those precooked 10 minutes. From the original raw weight to the final cooked weight (i.e., when broilers were ready to eat) precooked broilers decreased 20 to 26% in weight, untreated controls decreased 16%.

There was a correlation between weight losses and juiciness of broilers. In most instances, scores for juiciness were lowest for broilers precooked 10 minutes, intermediate for those precooked 3 minutes and highest for untreated control broilers.

After 15 weeks of storage at 0° F., untreated broilers were superior to precooked broilers in all palatability factors that were tested. The kind of packaging used did not significantly affect the flavor changes that occurred in untreated or in precooked broilers. Broilers precooked for 3 minutes prior to freezing developed more off-flavor than did broilers precooked for 10 minutes. Flavor changes occurred in the meat as well as in the skin of the precooked broilers.

Acknowledgment

The authors wish to express appreciation for the suggestions of Dr. John C. Ayres, Department of Dairy and Food Industry, and for the laboratory assistance of Mrs. Virgil Bohnenkamp. Appreciation is extended also to the members of the taste panel for their cooperation.

LITERATURE CITED

1. Gilpin, G. L., Dawson, E. G., Toepfer, E. W., and Warren, H. W. Palatability and nutritive value of homecanned chicken prepared by different methods for processing. U.S.D.A. *Tech. Bull. 1054* (1952).
2. Hanson, H. L. Processing pre-cooked frozen poultry products. Institute of American Poultry Industries Fact Finding Conference (mimeo.). (1954).
3. Hanson, H. L., Fletcher, L. R., and Lineweaver, H. Time-temperature tolerance of frozen foods. XVII. Frozen fried chicken. *Food Technol.*, 13, 221 (1959).
4. Sair, L., and Cook, W. H. The effect of precooling and rate of freezing on the quality of dressed poultry. *Can. J. Research*, 16D, 139 (1938).
5. Valdes, R. M. Effects of pretreatment and type of packaging material on quality of fresh and frozen broilers. (Unpublished M.S. thesis, Ames, Iowa, Iowa State College Library, 1955.)
6. Woodroof, J. G., Thompson, H. H., and Cecil, S. R. Peanut oil. I. The stability of peanut oil. II. Comparison of peanut oil with other cooking oils. Georgia Agr. Exp. Sta. *Bull. 247* (1946).
7. Woodroof, J. G., and Shelor, E. Prevention of bone darkening in frozen packed chickens. *Food Inds.*, 20, 48 (1948).

Microscopic Structure and Reconstitution of Vacuum-Dried Tomato Powders

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PRESERVATION OF FOODS as powder concentrates has received increased attention in recent years and one of the promising methods for manufacture of fruit juice powders employs vacuum drying combined with heat treatments *(2, 6, 7, 14, 18, 19)*. In the production of tomato juice powder by this method *(6, 7)*, a paste of 25 to 36% solids is aerated, spread about ⅛-inch deep on trays, and dried in a vacuum shelf drier. A vacuum of 1 to 1.5 mm. is drawn and heat is applied to dry the product to 3% or less moisture content.

Although suitable for other uses, as in condiments and soups, not all powders so produced could be reconstituted as single-strength juices of acceptable consistency and flavor. Some powders formed watery, granular products in which large powder fragments did not readily disperse and retained identity even after vigorous stirring. With other powders particle dispersion was rapid and juices of desirable qualities were obtained within 3 or 4 minutes.

These differences suggested need for an evaluation of structure in the original juices and pastes as well as in the reconstituted product. Microscopic examinations consequently were made and it was found that rapid reconstitution usually was characteristic of those powders made from original products which contained a high proportion of intact, separated tomato tissue cells *(6)*. On the other hand, pastes containing tissue particles composed mainly of broken cells and cell wall fragments were found to form vacuum-dried powders which either reconstituted slowly or had inferior consistency.

These microscopic investigations included examination of whole, fresh tomatoes as well as determinations of the distributions of the different sorts of tissue particles in both original and reconstituted products. The present paper describes both those observations and a simple procedure for evaluating the powders according to the powder structure and dispersion in reconstituted juices.

MATERIALS AND METHODS

Materials. Pastes used in preparation of the powders were obtained from commercial sources or were produced at this Laboratory by concentrating a commercial juice to about 36% total solids. The commercial pastes had been manufactured by "hot break" and "cold break" processes. The specific treatments used in the "hot break" process may be briefly described as follows: Coarse crushing of whole, fresh fruit rapidly followed by preheating to 180° F. in a heat exchanger, heating to 240° to 260° F. by steam injection, and concentrating to about 7% solids in a one-pass tube and shell unit. The hot product was then held a short time in a tank before sieving through paddle-type pulpers and finishers to remove skins, seeds and vascular tissues. The separated juice was then run through tube-type evaporators to bring the concentration up to 30 to 36% solids. In the "cold break" process the coarse crushing operation was followed by preheating to 140° F. and the product was held to permit enzymatic degradation of the pectin. The product was then further heated, sieved and concentrated.

The commercial juice had been manufactured by a third process. Briefly, coarsely chopped fruit was cooked on a continuous basis by retaining in a heated tank held at 205° to 210° F. for approximately 15 minutes. It was then sieved through a screw-type expeller. Only a controlled portion of the total possible juice was expelled and canned as juice; the remainder was processed as a paste. The concentration of juice was carried out in this Laboratory using a steam-jacketed evaporator with mild agitation. Preparation of powders from these 3 types of products was accomplished as described elsewhere for the vacuum drying process *(6)*.

Several experimental pre-drying treatments were used in preparation of some of the powders. Some were treated overnight with pectic enzymes to degrade the pectins; others had calcium chloride added at a concentration of about 0.5% of the total soluble solids to increase their viscosity prior to aeration and drying. Aeration of all samples was effected by beating with a wire whip until density of about 0.7 to 0.9 g. per ml. was obtained.

Microscopic methods. Sections of fresh, ripe tomatoes were used to illustrate some of the histological features of the flesh and seed cavity tissues. Freshly stewed tomatoes as well as commercial pastes and juices and their reconstituted powders were studied with both ordinary and polarizing microscopes. Examination and classification of suspended tissue particles were accomplished with samples of single-strength juices diluted approximately to 1: 400 by volume with distilled water. Differences in distribution of the various kinds of tissue particles present were determined at 100 X magnification from counts of 1,000 or more particles per sample, using counting chamber slides as described for studies on apricot purees *(10)*.

Reconstitution method. Rates of powder particle dispersion were determined from samples reconstituted to the approximate total solids of single-strength juice (about 6.5%). A weighed sample of the powder was placed in a beaker and the proper amount of water added. For rapid, routine tests, 1.3 g. of powder and 18 ml. of water in a 50-ml. beaker were found convenient. Up to 10 times these amounts in a larger beaker did not alter reproducibility of results. When water was added the sample was stirred gently 3 to 4 times with a glass rod to insure uniform wetting of the powder; the sample was then left undisturbed for 90 seconds. After 90 seconds the sample was again stirred gently for 30 seconds, using a uniform motion of about 2 revolutions per second of the glass rod around the sides of the beaker.

Two samples of 0.5 ml. each were immediately removed with calibrated medicine droppers and spread carefully over the surfaces of separate 1- x 3-inch, clean microslides. The tip openings of the medicine droppers were enlarged to about 2 mm. diameter for passage of larger powder particles, and after each sampling the droppers were flushed with water. In an alternate method of sampling, 1-ml. samples were placed in counting chamber slides. This procedure of reconstitution and sampling was repeated several times in succession, allowing 90 seconds' delay between each interval of 30 seconds in which the sample in the beaker was stirred. Thus, samples representing inter-

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vals ranging from 2 to 20 minutes for powder reconstitution were obtained.

Preliminary microscopic observations at low magnifications provided suitable criteria for ready recognition of the undispersed, opaque powder particles, but use of a microscope for making the counts was a disadvantage; transmitted light decreased particle opacity and magnification restricted the field of view so that counts could not be made rapidly. After a few practice trials, consistent replicate counts of undispersed powder particles could be made rapidly without magnification and without critical verification of particle size. These undispersed particles could be distinguished with the naked eye by certain characteristics of opacity from more translucent, fully dispersed, suspended tomato tissue particles. Only those undispersed particles having dimensions of 0.3 mm. or more (by approximation) and which appeared definitely opaque against a white background were counted.

OBSERVATIONS AND RESULTS

Histology of ripe tomato. Although the structure of the fruit has been described in several studies *(1, 4, 11, 12, 15, 17)*, few photomicrographs of the intact, fresh tissue have been published. The solid flesh, excluding only the basal core, is composed principally of very large parenchyma cells which range from 200 to 1,200 μ in their greatest dimensions (Figure 1). Numerous, small intercellular spaces are present and these range from 1 to 10 μ wide to over 100 μ long between adjacent parenchyma cells. The cells of the skin and vascular tissues are much smaller and have minute intercellular spaces.

The watery, gelatinous tissue in the locules or seed cavities likewise is composed of parenchyma cells (Figure 3). This tissue develops as an outgrowth of fleshy tissue near the seed attachments of the young fruit and generally contains starch granules when the fruit is green *(11)*; it is independent of the seed coats. A less extensive gelationous tissue forms the outer layer of the seed coats from which it originates; the radial and basal walls of its cells show pronounced thickening of a hydrated, somewhat gelatinous cellulose *(4, 11)*. These gelatinous tissues have few evident intercellular spaces; their cells become very fragile in the ripe fruit. The cells of the locule tissue proper rupture easily and tend to separate in the ripe fruit—thus appearing like a free juice as described by Whittenberger and Nutting *(15)*.

The parenchyma cell walls in the solid flesh of the fruit are strongly birefringent when examined with polarized light (Figure 2) and are very thick when compared with the thin, fragile walls of the gelatinous tissue cells. The latter are weakly birefringent at best (Figure 4) and evidently contain only the first formed layer of cellulosic microfibrils of the primary wall. Near the basal portions of the gelatinous tissue the cell walls are thicker than in those cells more distally located and a few starch granules still may be present in these basal cells in the ripe fruit (lower portions of Figures 3 and 4).

Minute crystals of carotene and lycopene are embedded in the cytoplasm of both flesh and locule tissue cells. Concentration of these pigments appears to be greatest in skin region of the solid flesh and also greater in the flesh than in the locule tissue. This latter difference, however, may be due to the opacity of the flesh tissue (due to gas in intercellular spaces) against which the finely divided pigments are more readily evident to the naked eye than in the translucent, gelatinous tissue. Pigment formation in the skin and flesh has been extensively investigated *(12)* but little attention has been given to locule tissue pigment. Microscopic examinations suggest that these gelatinous tissues possibly may contain more numerous minute carotenoid bodies than do the solid flesh tissues.

Microscopic structure of juices and pastes. The various treatments used in juice and paste manufacture result in structural distinctions between the final products. Ordinary cooking, for example, causes an appreciable amount of cell separation (Figure 5) and the degree of cell separation increases with time of cook. Structure of the commercial juice used here is shown in Figure 6 and is grossly comparable with the structure obtained with simple cook treatment. Ordinary cooking, *per se*, does not cause cell rupturing in tomatoes or in other plant tissues *(13)* but the cell walls have been weakened and are consequently rendered more susceptible to mechanical damage such as may be exerted by shear forces. High degrees of cellular breakdown due to such mechanical damage are shown in Figures 7 and 8 for "cold" and "hot" break pastes, respectively.

Table 1 shows the proportion of different types of suspended tissue particles in several juices and pastes. Very similar distributions were found in the fully reconstituted vacuum-dried powders prepared from them. A high degree of cellular damage was characteristic of all products manufactured by processes which subjected the cooked tissue particles to shear forces exceeding those used in manufacture of the commercial juice of these present studies. Speed of operation and sieve opening appeared to have the greatest influence on particle structure after heating or cooking at high temperatures.

TABLE 1

Tissue particles: types and distribution in tomato pastes and juices and in reconstituted juices from their dried powders

Sample	Suspended tissue particles, % of total numbers			
	Intact separated cells	Clusters of intact cells	Broken cells and cell wall fragments	Skin and vascular tissue fragments
Commercial juice (original)	60	4	35+	1
Reconstituted powder from commercial juice	52	3	44+	1
Commercial "hot break" paste (original)	32	3	64+	1
Reconstituted powder from commercial "hot break" paste	26	3	70+	1
Commercial "cold break" paste (original)	8	1	90+	1
Reconstituted powder from commercial "cold break" paste	4	1	94+	1

Rates of powder particle dispersion. The gross structure of vacuum-dried powder particles is very porous (Figure 9). When such particles are wet with water during microscopic observation, recognizable fragments of tomato tissue can be seen to separate and disperse into the water (Figures 10 and 11). Particles which did not readily disperse remained opaque; when teased with a needle they separated into smaller translucent particles consisting of the tissue particle classes listed in Table 1, but they were principally composed of broken cells and cell wall fragments.

Ease of particle dispersion upon reconstitution varied with different powders and this difference could be graphically observed in the microslide preparations. Numbers of undispersed opaque particles for 2 reconstituted samples are compared in microslide preparations shown in Figure 12. These reconstituted powders, left and right, respectively, represent the commercial juice and "cold break" paste structures described in Table 1.

Rates of powder particle dispersion obtained from counts of several reconstituted powders are illustrated in Figures 13 and 14. The differences in dispersion shown in Figure 13 are inverse to the percentage distributions of suspended, intact, separated cells listed in Table 1 for these same products both before and after powder manufacture. Dispersion of powder A (Figure 13) was considered excellent; within 4 minutes after addition of water the reconstituted juice from this powder could not be distinguished from the original. Inferior dispersion is shown by C in Figure 13 and by A and D in Figure 14. Such powders remained granular and watery, never reaching full reconstitution even after vigorous stirring, and large numbers of undispersed powder particles remained after 20 minutes' reconstitution. Powder B in Figure 13, from the "hot break" paste, showed good consistency when fully reconstituted but powder particle dispersion was slow, requiring 10 minutes to reach the same degree of dispersion shown by

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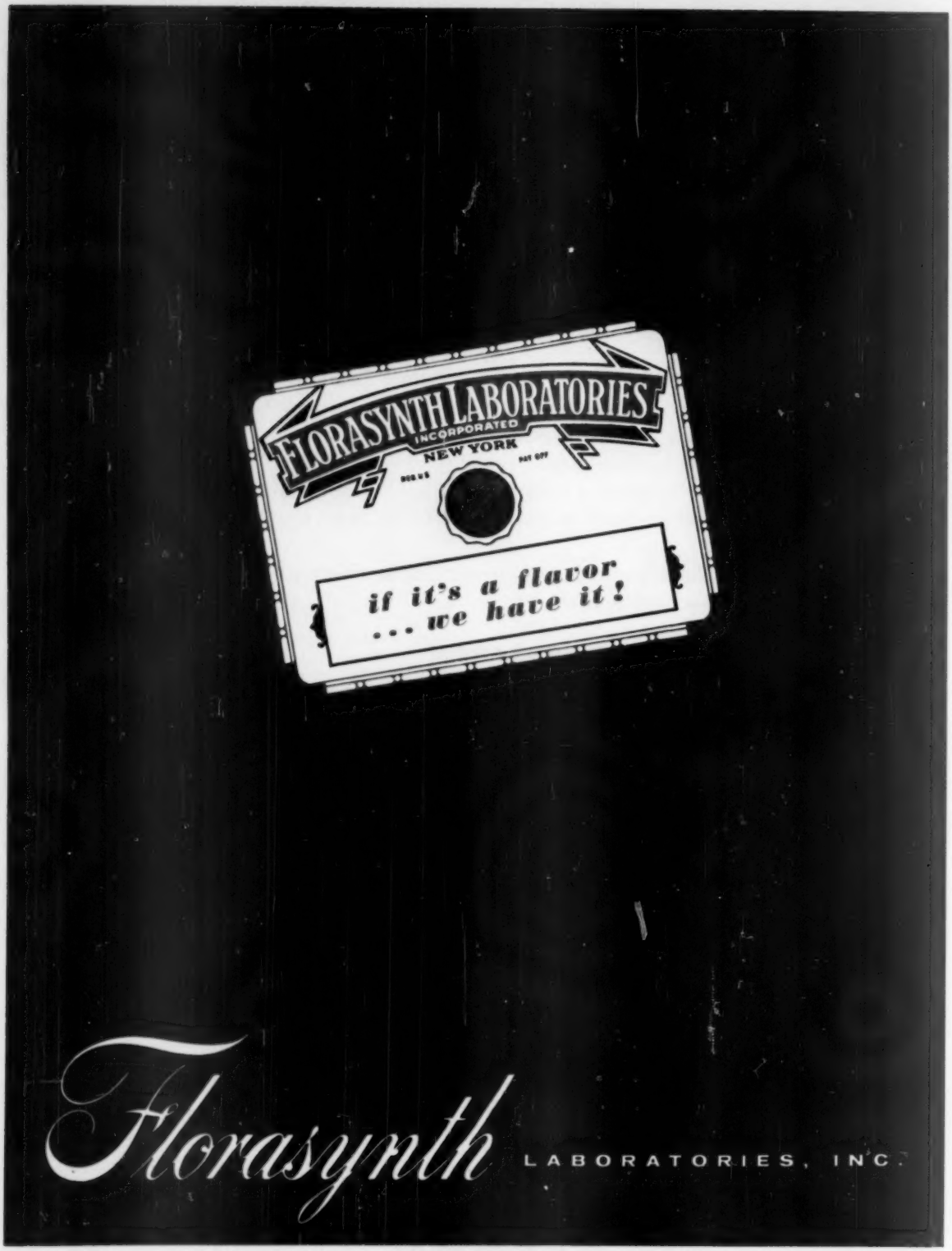

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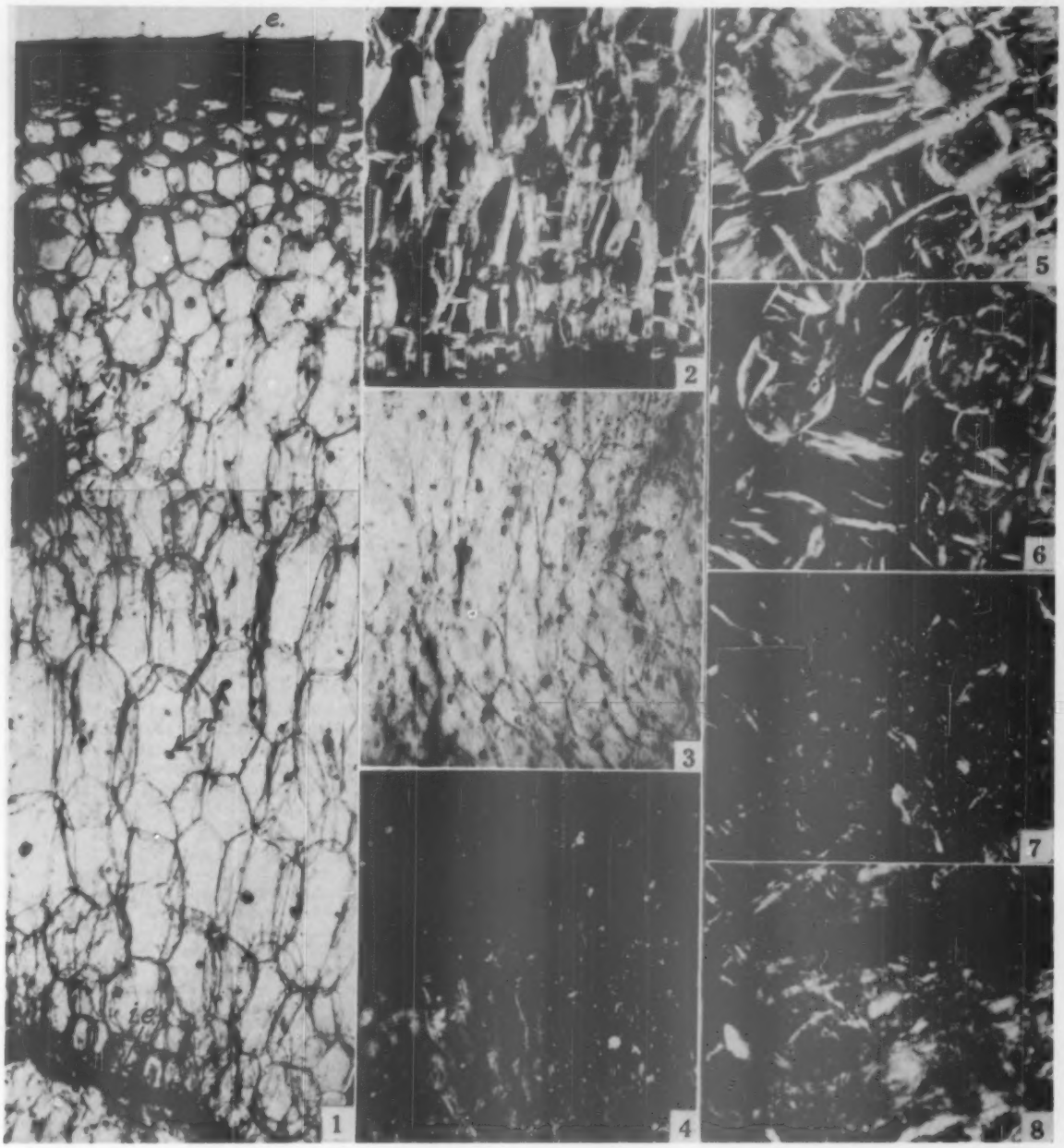
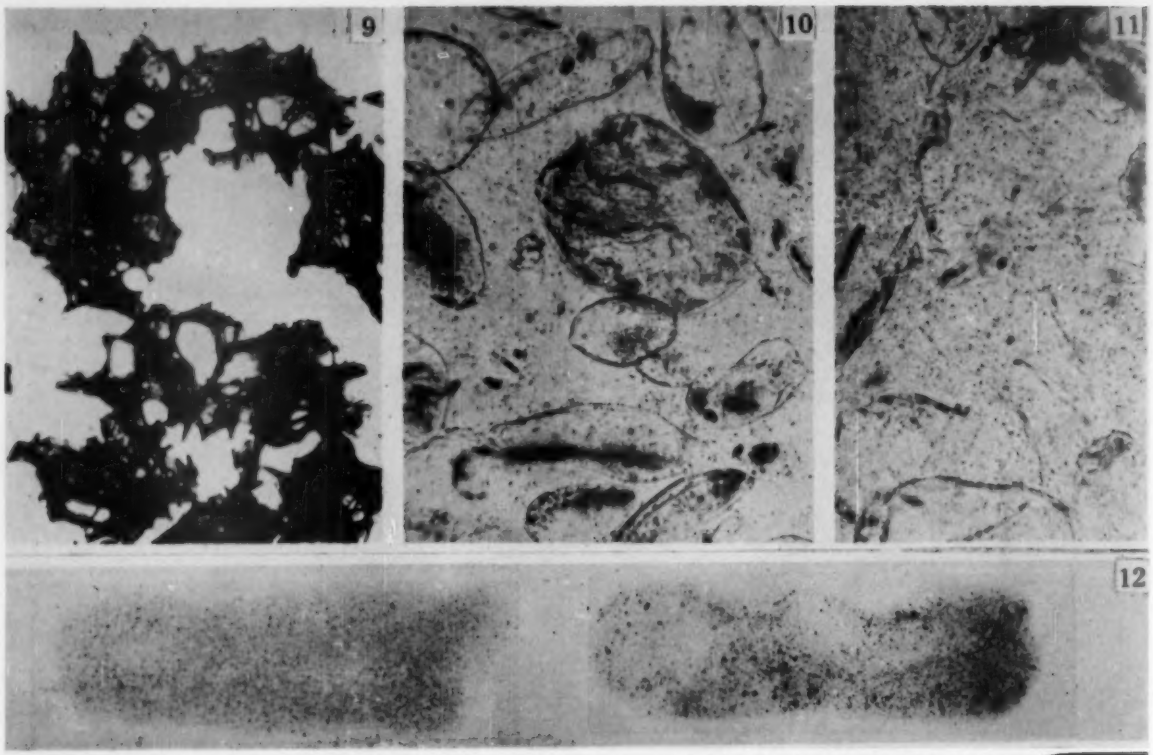


Figures 1 to 4—photomicrographs of fresh sections of tomato fruit, × 40. Figure 1—fresh section, about 500 microns thick, of outer wall of flesh photomicrographed with ordinary illumination. Small-celled skin and vascular tissues with minute intercellular spaces appear dark and opaque at this section thickness; e—epidermis; i.e.—inner epidermis; v—vascular bundle; n—nuclei of flesh cells. Figure 2—portion of inner margin of fruit wall photomicrographed with polarized light to show cell wall birefringence. Figure 3—gelatinous tissue of seed cavity photomicrographed with ordinary illumination; note very thin cell walls. Figure 4—same section as in Figure 3 photomicrographed with polarized light and showing weak birefringence of cell walls; small starch granules and pigment crystals show as minute bright spots.

Figures 5 to 8—photomicrographs of processed tomato as viewed with polarized light; × 40. Figure 5—cooked tomato, undiluted and showing birefringent walls of intact, separated cells. Figure 6—reconstituted powder prepared from a commercial juice (A in Figure 13) and showing intact, separated cells as in 5. Figure 7—reconstituted powder from a "cold break" paste showing cell wall fragments. Figure 8—reconstituted powder from a "hot break" paste; dark shadow is a vascular tissue fragment slightly out of focus. All views here are of undiluted preparations.



Figures 9 to 12. Figure 9—powder particles of a vacuum-dried commercial juice showing the porosity of the particles; × 10. Figures 10 and 11—intact separated cells and cell wall fragments, respectively, separated from reconstituted powder further diluted 1:10 with water to provide a relatively clear background, × 40. Figure 12—microslide preparations of reconstituted powders showing difference in particle dispersion; left, preparation from powder prepared from commercial juice and showing rapid, virtually complete particle dispersion; right, preparation from a powder prepared from a "cold break" paste and showing poo. particle dispersion.

powder A in 2 minutes. Although it was possible to prepare powders from some "hot break" pastes which were of acceptable consistency when reconstituted, none showed as rapid or complete powder particle dispersion as was usually obtained with those prepared from the commercial juice used here (upper slide, Figure 12).

Effects of paste preparation. One experimental method of paste preparation for vacuum drying involved separation of paste into pulp and serum fractions with addition of the serum to whole paste prior to aeration and drying. Some pulp and serum fractions, however, were vacuum-dried separately. The powder particles of the serum fraction dispersed immediately upon reconstitution, containing only very small amounts of suspended tissue particles, but the dried pulp did not disperse well and was comparable in appearance with wet fragments of paper pulp.

Proper aeration of whole paste prior to drying was found to be a critical factor. Delay after aeration and before drying adversely influenced particle dispersion in the reconstituted powder. For example, A in Figure 14 represents the dispersion obtained with powder made from paste held one hour after aeration and B is for powder of the same paste with no delay between aeration and drying. In A, syneresis and coalescence of finely divided air bubbles in the paste occurred during the delay period so that the paste did not puff well during dehydration.

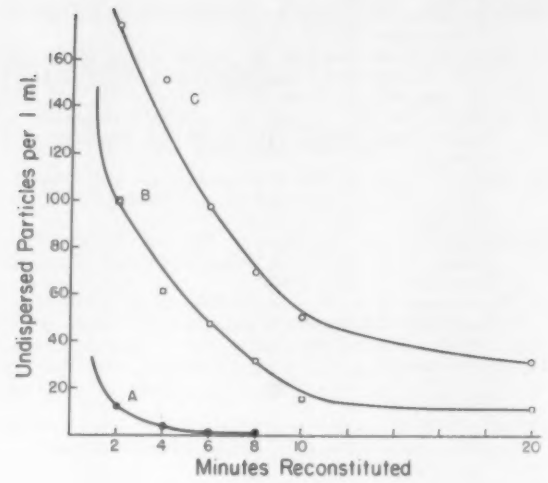
Additives also affected both paste aeration and particle dispersion of the reconstituted sample. Small amounts of added egg albumin aided in paste aeration and also slightly increased the rate of powder particle dispersion. When calcium chloride was added to the paste prior to aeration and drying, no apparent effect on particle dispersion was obtained (compare C and B in Figure 14, also with A in Figure 13), but the reconstituted juice from such a powder was watery until it had stood for 20 minutes or longer and was further mixed.

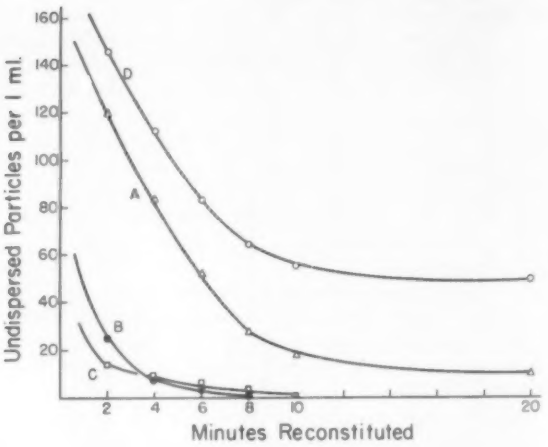
Treatment of pastes concentrated from commercial juice with Pectinol to degrade the pectic materials resulted in very poor aeration properties even when aeration was attempted at low temperatures. Powders prepared from these enzyme-treated pastes had inferior particle dispersion when reconstituted (D in Figure 14). Reconstitution with boiling water increased particle dispersion slightly in these powders. The undispersed particles consisted of many tightly interlocked or bonded cellulosic wall fragments and shrunken intact cells. Even treatments with hot solutions of 30% urea, of 10% sodium hydroxide, or with 50% formamide at room temperature did not effect a complete powder particle dispersion, except with prolonged treatment.

Within certain limits the size of particles of ground powder did not appear to have marked influence on rate of particle dispersion during reconstitution. Particles retained on and those passing a 16-mesh screen showed nearly the same rapidity of dispersion as the unsieved sample. The individual spongy particles of all of these vacuum-dried powders show different degrees of porosity (Figure 9) partly due to variation in thickness of the walls bordering the air pockets and partly due to the fact that the intact tissue cells were not entirely collapsed in the dry condition. Apparently it is this microporosity, due mainly to the intact cells, that is important for rapid reconstitution.

DISCUSSION

As demonstrated here, processes which result in reduction of intact cellular particles in tomato pastes





Figures 13 and 14—rates of powder particle dispersion as revealed by counts of undispersed particles; Fig. 13A—from a commercial juice; B—from a "hot break" paste; C—from a "cold break" paste. Fig. 14A—from a commercial juice the aerated paste of which was held one hour before vacuum drying; B—no delay after aeration (control); C—from paste of a commercial juice with added calcium chloride (0.5%); D—from a Pectinol-treated paste of commercial juice.

and juices to cell wall fragments as the predominant type of suspended particle are apt to result in problems of aeration and inferior reconstitution qualities when such products are vacuum-dried. On the other hand, a tomato juice or paste in which 50% or more of the suspended tissue particles are composed of intact, separated cells, and in which the pectic materials have not been too severely degraded, are easier to prepare for vacuum-drying and the resulting powder reconstitutes rapidly and is of good consistency as an instant juice.

The importance of pectic materials in the consistency of tomato products is well recognized *(8, 9, 15)*, and, of course, these substances also are significant to the reconstituting qualities of the vacuum-dried powders. On the other hand, recent investigations on consistency and suspended tissue particles in tomato products *(3, 15, 16)* have demonstrated that thicker consistencies result when linearity of the cellulosic wall materials is increased by breaking the more or less spherical flesh cells into cell wall fragments of irregular linear dimensions. Comparable results have been obtained at this Laboratory with apricot purées. It appears, then, that all of the conditions of particle structure which favorably increase consistency in juices and pastes may not be desirable if such products are intended for the manufacture of vacuum-dried powders in which rapid reconstitutibility is intended.

The large numbers of intact flesh cells aid in paste aeration and prevent the cellulosic wall materials from becoming too tightly enmeshed or bonded when the product is vacuum-dried, and thus affords rapid reconstitution. It is possible to visualize a mechanism of powder particle dispersion which involves thin layers of various soluble carbohydrates between the cellulosic surfaces of the tissue particles in the dried powder. Upon reconstitution of the powder, these layers dissolve readily so that the tissue particles rapidly disperse.

The procedures used here for estimating rate of powder particle dispersion upon reconstitution may have useful testing application. The method is simple, graphically reveals dispersion characteristics, and can be readily augmented with microscopic observations. Comparative gross qualities of wateriness or body in the reconstituted product also are readily distinguished by the amount of fine colloidal material evident in the slide preparation.

SUMMARY

A simple method for testing particle dispersion and reconstitution is described. Particle dispersion characteristics and gross differences in consistency of the product are graphically revealed in preparations of the reconstituted juice made either on plain microslides or in counting chamber slides.

Reconstituted juices made from vacuum-dried tomato powders have the same structural characteristics as the pastes used for their manufacture. From 70 to 90% of the suspended tissue particles of some pastes consisted of broken flesh cells and cellulosic wall fragments. The vacuum-dried powders of these were slow to reconstitute and the suspension was often inferior as a juice. A commercial juice, with intact cells comprising about 60% of the suspended tissue particles produced a vacuum-dried powder of excellent reconstitution qualities; complete dispersion of the powder particles was obtained in 4 minutes.

Condition of the pectins in the original paste also influenced powder reconstitution. Enzymatic degradation of the pectins in a paste with a high percentage of intact cells, adversely influenced aeration of the paste prior to drying and resulted in a vacuum-dried powder which constituted poorly to give a granular and watery juice.

LITERATURE CITED

1. Briosi, Giovanni, and Gigli, T. Intorno all struttura anatomica ed alla composizione chimica del frutto de Pomodoro (*Lycopersicum esculentum* Mill.). *R. Acad. Ist. Bologna Rend.*, **1889**, 59 (1889).
2. Copley, M. J., Kaufman, Vern F., and Rasmussen, C. L. Recent developments in fruit and vegetable powder technology. *Food Technol.*, **10**, 589 (1956).
3. Hand, D. B., Moyer, J. C., Ransford, J. R., Hening, J. C., and Whittenberger, R. T. Effect of processing conditions on the viscosity of tomato juice. *Food Technol.*, **9**, 228 (1955).
4. Hayward, H. E. *The Structure of Economic Plants.* The Macmillan Company, New York (1938).
5. Kaufman, Vern F. U. S. Letters Patent 2,785,077 (1957).
6. Kaufman, Vern F., Reeve, Roger M., and Wong, Francis F. U. S. Letters Patent 2,858,226 (1958).
7. Kaufman, Vern F., Wong, Francis F., Taylor, D. H., and Talburt, William F. Problems in production of tomato juice powder by vacuum. *Food Technol.*, **9**, 120 (1955).
8. McColloch, R. J., Keller, George J., and Beavens, E. A. Factors influencing the quality of tomato products. I. Surface-localized pectic enzymes inactivated by blanching. *Food Technol.*, **6**, 197 (1952).
9. McColloch, R. J., Nielsen, B. W., and Beavens, E. A. Factors influencing the quality of tomato paste. II Pectic changes during processing. *Food Technol.*, **4**, 339 (1950).
10. Reeve, Roger M. Microscopic structure of apricot purées. *Food Research*, **21**, 329 (1956).
11. Smith, O. Pollination and life history studies of the tomato (*Lycopersicon esculentum* Mill.). Cornell Univ. Agr. Exp. Sta. *Mem. 184* (1935).
12. Smith, O. Effects of light on carotenoid formation in tomato fruits. Cornell Univ. Agr. Exp. Sta. *Mem. 187* (1936).
13. Sterling, Clarence. Effect of moisture and high temperature on cell walls in plant tissues. *Food Research*, **20**, 474 (1953).
14. Strashun, S. I., and Talburt, William F. Stabilized orange juice powder. I. Preparation and packaging. *Food Technol.*, **8**, 40 (1954).
15. Whittenberger, R. T., and Nutting, G. C. Effect of tomato cell structures on consistency of tomato juice. *Food Technol.*, **11**, 19 (1957).
16. Whittenberger, R. T., and Nutting, G. C. High viscosity of cell wall suspensions from tomato juice. *Food Technol.*, **12**, 420 (1958).
17. Winton, A. L., and Winton, Katherine B. *Structure and Composition of Foods.* II. 1935. John Wiley and Sons, Inc., New York, N. Y.
18. Wong, Francis F., and Bohart, George S. Observations on the color of vacuum-dried tomato juice powder during storage. *Food Technol.*, **11**, 293 (1957).
19. Wong, Francis F., Dietrich, W. C., Harris, Jean, and Lindquist, F. E. Effect of temperature and moisture on stability of vacuum-dried tomato juice powders. *Food Technol.*, **10**, 96 (1956).

Microbiological Aspects of Pressure Packaged Foods. II.

The Effect of Various Gases[a]

(Manuscript received April 3, 1959)

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THE PROCESS REQUIREMENTS of the various classes of foods were reviewed by Hays and Riester *(5)* who concluded that unless the product was to be refrigerated, the process requirements of pressurized foods will be essentially the same as for comparable conventionally canned foods. Giggard and Gottschall *(2)* reached similar conclusions, and suggested the attainment of "commercial sterility," either by gassing while the product was hot, by giving a thermal process to charged products, or by using some modification of aseptic canning.

A number of investigators *(1, 3, 4, 9, 10, 11, 12, 13, 14)* have observed the effects of carbon dioxide or nitrogen on the growth of microorganisms, but these studies have not dealt with pressures in the range used to pressurize foods. There also have been a number of studies on the longevity of microorganisms in carbonated beverages with maximum pressures of about 4 atmospheres *(1, 6, 9, 14)*. Prucha *et al. (11)* observed that milk held under 60 pounds carbon dioxide pressure did not sour for 9 days, while untreated milk became sour within 30 hours. Swearingen and Lewis *(13)* observed an approximate 50% reduction of an *E. coli* suspension within 20 minutes when subjected to carbon dioxide at a pressure of 350 atmospheres. Larson *et al. (10)* found that nitrogen was not lethal for *E. coli* at a pressure of 120 atmospheres. Johnson and Lewin *(7, 8)* observed that hydrostatic pressures in excess of 1000 atmospheres were required to produce germicidal effects.

The objective of this study was to determine if any of the commonly used food propellents would inhibit the growth of food spoilage organisms. If so, then it might be possible to use less severe processes to render "commercially sterile" foods pressurized with that gas.

EXPERIMENTAL PROCEDURE

Pressurized cans of culture media were prepared in the following manner: aluminum foil was crimped over the one-inch cups of the pressure containers of media before sterilization and was left on the cans until the sterile media had cooled. Then, the media were inoculated and sterile valves were crimped onto the cans. The valves were sterilized by opening their seats in a solution containing approximately 200 p.p.m. active ingredient of an iodophor. The orifices of the valves were swabbed with the iodophor and the valves left to soak for about one hour in this solution. After the valves were crimped onto the cans, one set of containers of media was charged to 90 p.s.i.g. with each of the following propellents: nitrogen, nitrous oxide, carbon dioxide, 85 N_2O/15 CO_2, 75 N_2O/25 CO_2,[b] 50 N_2O/50 CO_2[b] or 25 N_2O/75 CO_2.[b] The foregoing gas ratios are per cent by volume. In addition, inoculated cans of media also were pressurized after the oxygen content of the headspace gases had been reduced by drawing 27 inches of vacuum on the containers.

Aluminum capped non-pressurized control cans were included for obtaining initial counts and for determining the normal growth response of the spoilage organisms in the various media. The control and pressurized samples were incubated at 90° F.

Media and methods. With the exception of the medium in which spores of *Bacillus coagulans var. thermoacidurans* were inoculated, media normally employed in these laboratories for cultivating the various test organisms, as shown in Table 1, were used in the pressure cans.

TABLE 1

Media used to determine effects of propellents on growth of microorganisms

Organisms	Media used in pressure cans
Heat Resistant Spores	
P.A. No. 3679	Beef heart anaerobic broth
Clostridium botulinum	Beef heart anaerobic broth
Clostridium butyricum	Orange serum broth
Bacillus coagulans var. thermoacidurans	APT broth
Non-heat Resistant Conidia	
Aspergillus niger	Orange serum broth
Penicillium from fruit punch	Orange serum broth
Penicillium from syrup	Orange serum broth
Non-heat Resistant Microorganisms	
Aerobacter aerogenes	APT broth
Lactobacillus brevis	Orange serum broth
Lactobacillus plantarum	Orange serum broth
Leuconostoc mesenteroides	Orange serum broth
Staphylococcus aureus	APT broth
Streptococcus faecalis	APT broth
Yeast from beer	Orange serum broth
Saccharomyces cerevisiae	Orange serum broth
Pink torula	Orange serum broth

Initial counts of all test organisms except the mold cultures were made from the non-pressurized controls. Growth of the mold cultures were determined visually after opening the pressurized and non-gassed containers.

The initial count and the counts after incubation of all anaerobic cultures were estimated by culturing multiple tubes of decimal dilutions of these samples. The most probable number of each of the putrefactive anaerobes was determined in beef heart semi-solid medium, and similar counts of the butyric anaerobe were obtained in deep tubes of orange serum agar. Plate cultures of the samples inoculated with the other test organisms were used to determine the initial colony count and the counts after incubation. The samples inoculated with *A. aerogenes*, *S. aureus*, and *S. faecalis* were cultured in tryptone glucose extract agar. The lactic acid organisms and the yeast cultures were plated in orange serum agar, while *B. coagulans var. thermoacidurans* was cultured in thermoacidurans agar.

RESULTS AND DISCUSSION

Nitrogen. Nitrogen alone did not inhibit the growth of any of the test organisms. *A. niger* did not grow in

[a] Presented at the Nineteenth Annual Meeting of the Institute of Food Technologists, Philadelphia, May 20, 1959.

[b] These three gases were supplied through the courtesy of Air Reduction Co., Inc., Madison 10, Wisconsin.

those samples pressurized with nitrogen after the oxygen content of the headspace gases had been reduced by drawing 27 inches of vacuum on the containers. These data are given in Table 3.

Nitrous oxide. *C. botulinum* grew much less luxuriantly in medium charged with nitrous oxide than it did in samples gassed with nitrogen. The growth of *A. niger* was inhibited by nitrous oxide, and the penicillium from fruit punch did not grow in one of the two test packs. This gas was much more effective in inhibiting the growth of several of the fungi when the containers were pressurized after the oxygen content of the headspace gases had been reduced. Under this condition, none of the molds grew, nor did *S. cerevisiae* and the pink torula in one of two test packs. These data are included in Table 3.

Carbon dioxide. Carbon dioxide was found to be quite effective in inhibiting the growth of a number of the spoilage organisms. The only organisms that grew consistently in media charged with carbon dioxide were *B. coagulans var. thermoacidurans*, the lactic acid organisms, and *S. faecalis*. In one of two test packs, the yeast isolated from beer grew slowly in the variable in which the oxygen content of the headspace gases had not been reduced.

After two weeks' incubation, marked reductions were noted in the colony counts of the samples inoculated with *A. aerogenes, S. aureus, S. cerevisiae*, and the pink torula. Carbon dioxide inhibited the growth of all molds tested. This gas, as shown in Tables 2 and 4, exerted a lethal effect upon the spores of the anaerobes. After 42 days' incubation, the number of viable spores of *C. botulinum* and *C. butyricum* had been reduced markedly. During this same period, a slight but definite reduction in the numbers of spores of P.A. No. 3679 was noted.

In contrast, Koser and Skinner *(9)* did not observe any diminution in the number of putrefactive anaerobic spores after one month's storage at room temperature in samples pressurized with carbon dioxide. However, these investigators used a maximum pressure of 41 p.s.i.g., whereas 90 p.s.i.g. was used in this study.

Carbon dioxide markedly increases the acidity of media pressurized to 90 p.s.i.g. The pH of media, after charging to 90 p.s.i.g. in glass pressure tubes, was determined colorimetrically. Other samples of media were adjusted to the same pH level by the addition of acid. Cans of these sterile acidified media were inoculated and pressurized to 90 p.s.i.g. with nitrogen. As shown in Table 4, growth of these organisms was not inhibited. The data indicate that carbon dioxide *per se*, rather than its effect on pH, has an inhibitory effect.

Mixtures of nitrous oxide and carbon dioxide. At present, carbon dioxide is not used widely to pressurize foods, but a mixture of 85% nitrous oxide and 15% carbon dioxide is used extensively for whipped products. As nitrous oxide did not inhibit the growth of any of the bacteria tested and only a limited number of the fungi, mixtures of nitrous oxide and carbon dioxide were tested to determine the per cent of carbon dioxide necessary to inhibit growth.

The commercially available mixture of these gases (85 N_2O/15 CO_2) did not inhibit the growth of the bacteria which were inhibited by carbon dioxide at 90 p.s.i.g. *A. niger*, the penicillium from fruit punch, and the pink torula did not grow in the containers of medium in which the oxygen content had not been reduced before pressurizing with this gas mixture. None of the molds grew in the vacuum-gas variable.

The spores of *C. botulinum* did not germinate and grow in medium charged with the gas mixture containing 50% carbon dioxide. The gas containing 75% carbon dioxide inhibited the growth of *A. aerogenes*, but P.A. No. 3679, *C. butyricum, S. aureus*, the yeast from beer, and *S. cerevisiae* grew in media gassed with this mixture. These data are given in Tables 5 and 6.

TABLE 2

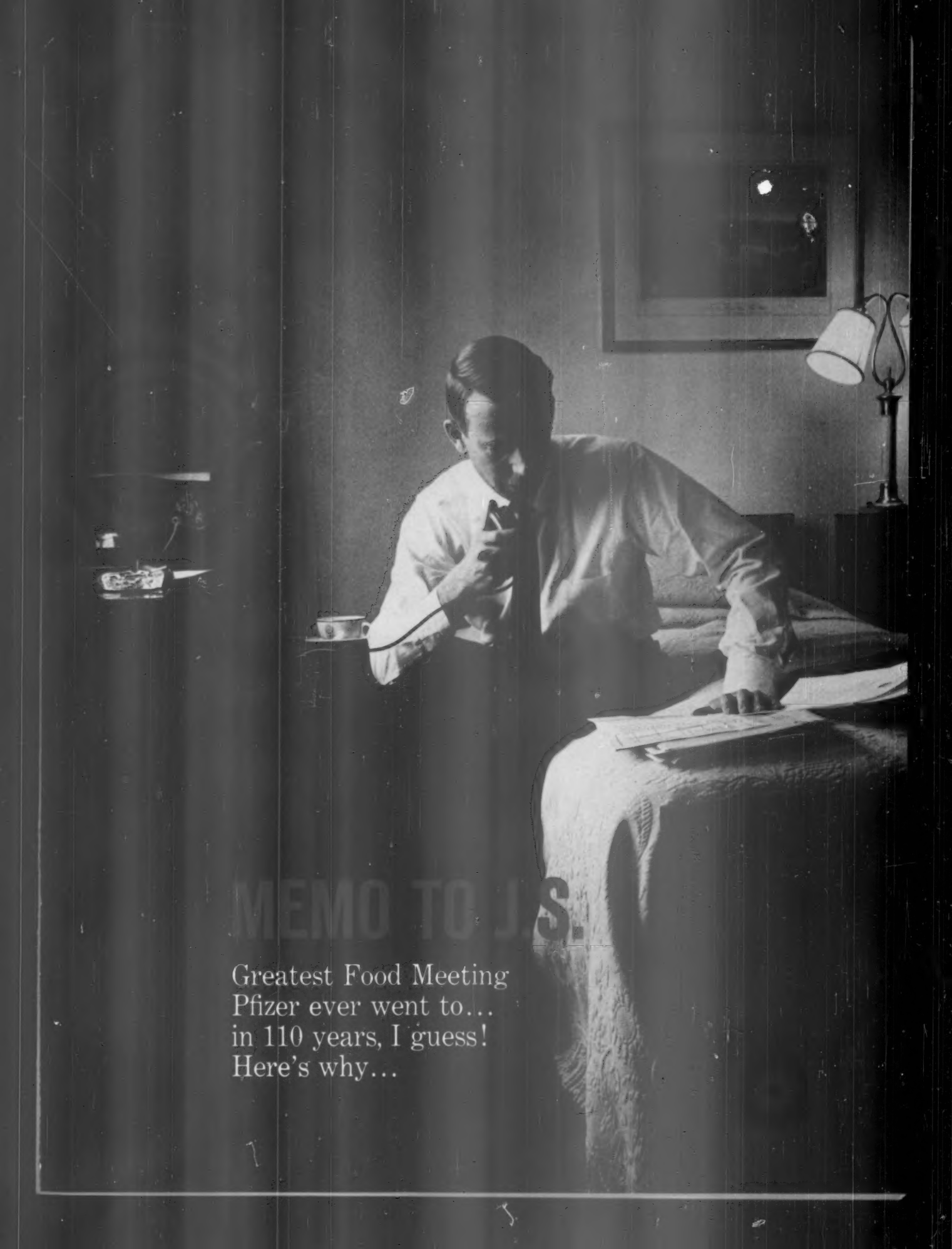
The effect of various gases at 90 p.s.i.g. upon the growth of bacteria

Test organism	No. of days[1] samples incubated before examination	Control not gassed	Gases used to pressurize samples		
			Nitrogen[2]	Nitrous oxide[2]	Carbon dioxide[2]
A. aerogenes	3	++	++	++	−
	13				− −
B. coagulans	3	++	++	++	++
C. botulinum	3	++	++	+	±
	42				− −
C. butyricum	3	++	++	++	±
	42				− −
P.A. No. 3679	3	++	++	++	±
	42				−
L. brevis	3	++	++	++	++
L. plantarum	3	++	++	++	++
L. mesenteroides	3	++	++	++	++
S. aureus	3	++	++	++	±
	13				− −
S. faecalis	3	++	++	++	++

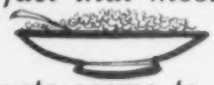
[1] Two inoculated packs were made with a minimum of five cans for each variable of test organism and gas. The growth of the various organisms were essentially the same in both packs, so the results are reported by only one set of data.

[2] The oxygen content of the headspace gases, whether reduced by drawing 27 inches of vacuum or not reduced, did not effect the growth of the test organisms. Only one set of data is given.

++ = Luxuriant growth with marked increase in colony count or M.P.N. over initial count.
+ = Growth with slight to moderate increase in colony count or M.P.N. over initial count.
± = The colony count or M.P.N. remained approximately the same as the initial count.
− = Slight but measurable decrease in colony count or M.P.N. from initial count.
− − = Marked decrease in colony count or M.P.N. from initial count.

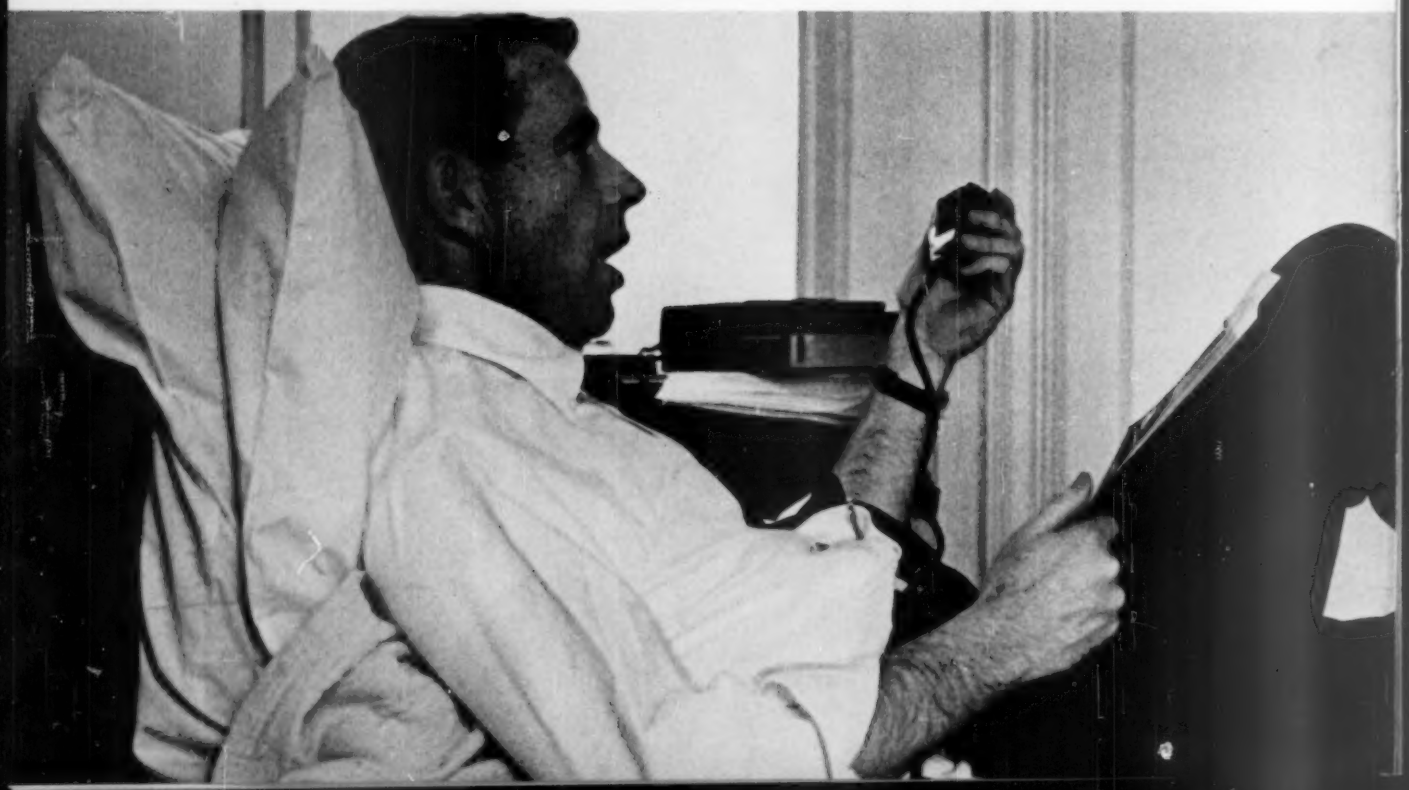

MEMO TO J.S.
Greatest Food Meeting
Pfizer ever went to...
in 110 years, I guess!
Here's why...

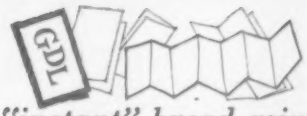
As you know, this is one of our top food conventions of the year. It was a real success. Our booth featured Pfizer nutritional products with the accent on Lysine and Vitamins. Sorbistat®K highlighted our preservatives section, and Glucono-Delta-Lactone our specialty products. **TO BE SPECIFIC—** *Charlie's paper on Lysine and the importance of this amino acid in improving the quality of cereal protein caused a great deal of favorable comment. Later on at the booth, we confirmed the fact that most of our customers accept the need for Lysine in cereal products.*



A big factor in the choice of Lysine over other protein supplements seems to be that Lysine does not affect the taste or texture of their finished product. After talking with many marketing men at the booth, we're certain the food industry has never been so nutrition-minded. Vitamin C fortification is snow-balling. It is increasingly clear that the food industry has found "enriched" to be a selling word—not only Vitamin C in fruit juices and beverages,

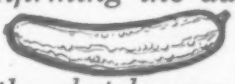
but also B_6 and B_{12} in the breakfast cereals. You can expect half a dozen new products enriched with Pfizer vitamins in the near future. One of our top projects has been the development of markets for our baking specialty products. Two of them, Glucono-Delta-Lactone and Sorbistat®K, are really taking hold. Taking them in order, I would say we gave out more literature on GDL than any other product.





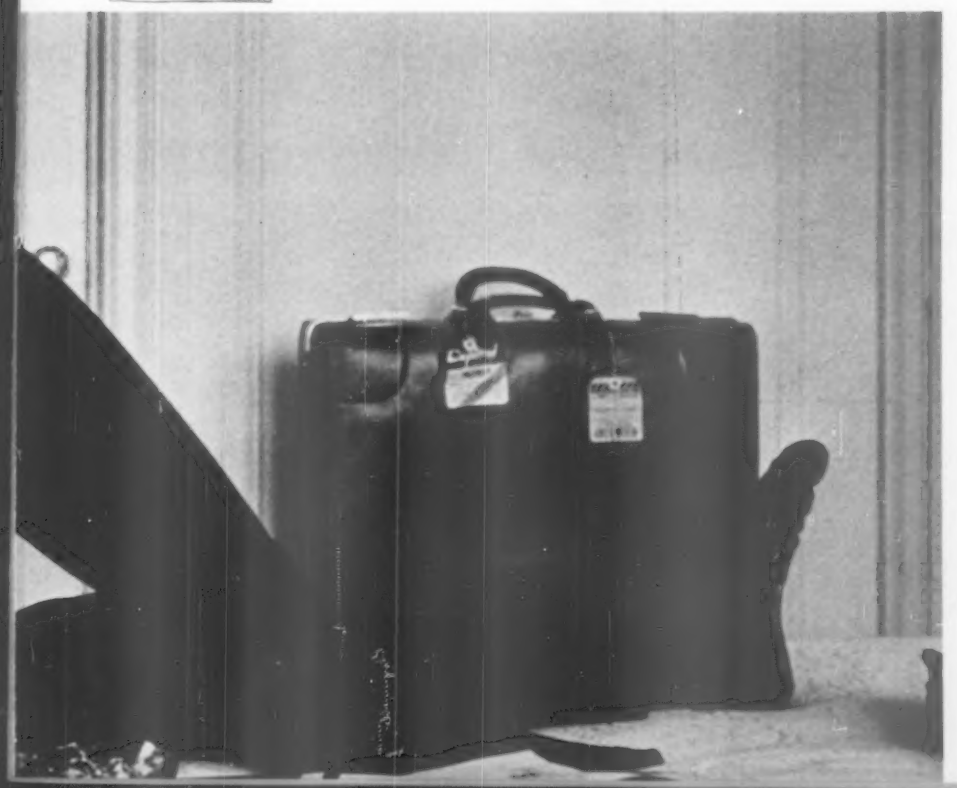
The work of the Quartermaster Corps in developing an "instant" bread mix, coupled with the more recent activities of our Technical Service group in developing new formulas for frozen rolls, prepared cake mixes and refrigerated biscuits, had tremendous impact. The chemical leavening story plus the unique processing advantages of GDL over presently used leavening acids is going to make available some products the industry did not believe possible.

Sorbistat®K with its vastly improved water solubility has really proved a boon to food manufacturers. Technologists from the baking, cheese, prepared foods, pickle, meat, wine—in fact, practically every segment of the industry—are confirming the advantages of Sorbistat®K in reducing yeast and mold spoilage.



One of the interesting sidelights was the comment caused by the sketch we put up in the booth of the new Pfizer multi-million dollar Research Center at Groton. This was a real conversation piece. Our visitors—particularly those in research—were impressed. It is gratifying to see the number of people who realize the help Pfizer can offer in nutrition, food preservation and allied fields. For the future, there are a lot of important new developments on the way in the food industry...and I can see areas where Pfizer experience, current research and products can make a significant contribution.

See you in Brooklyn soon...



NOTE: *The man working on this report is Mr. John Post of the Pfizer Chemical Sales Division, Food & Beverage Dept. He, like many Pfizer people, attends the important food conventions taking place during the year. Perhaps you can talk over your ingredient problem with a Pfizer representative at the next convention you attend. Here is a list of the important food industry meetings where Pfizer exhibits:*

Institute of Food Technologists
Association of Cereal Chemists
Association of Operative Millers
Western States Meat Packers Association
American Meat Institute
American Bottlers of Carbonated Beverages
Master Brewers Association

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Citric Acid
Sodium Citrate
Calcium Cyclamate
Sodium Benzoate
Tartaric Acid

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Calcium Cyclamate
Ascorbic Acid
Tartaric Acid
Cream of Tartar

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Tartaric Acid
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Citric Acid
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Sorbistat® K (Potassium Sorbate)
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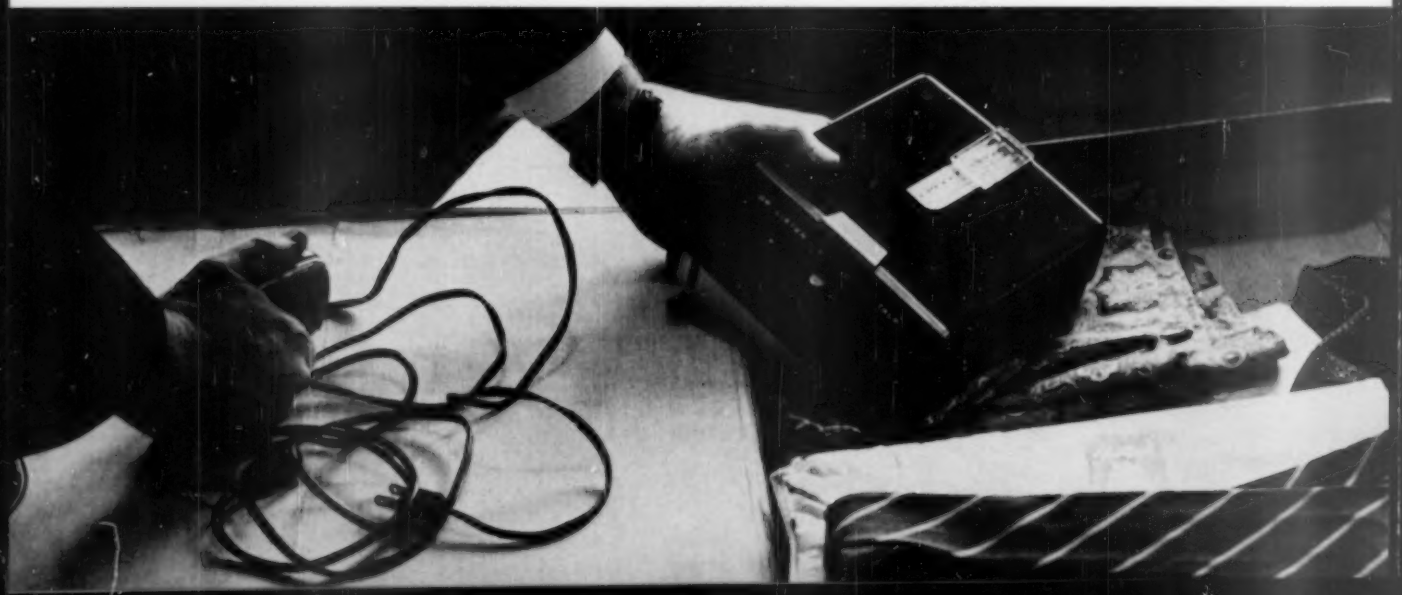

TABLE 3

The effect of various gases at 90 p.s.i.g. upon the growth of fungi

Organism	No. of days samples incubated before examination	Control not gassed	Gases used to pressurize samples					
			Nitrogen		Nitrous oxide		Carbon dioxide	
			No vac.	Vac.[1]	No vac.	Vac.[1]	No vac.	Vac.[1]
Yeast from beer	4	++	++	++	++	++	±	±
	4	++	++	++	++	++	+	−
	13						++	−
S. cerevisiae	4	++	++	++	++	±	−	−
	3	++	++	++	++	+	−	−
	15						− −	− −
Pink torula	4	++	++	++	++	±	−	−
	4	++	++	++	++	+	−	−
	13						− −	− −
A. niger	28	+++	++	±	±	±	±	±
	28	+++	++	±	±	±	±	±
Penicillium from syrup	28	+++	++	++	+	±	±	±
	28	+++	++	++	+	±	±	±
Penicillium from punch	28	+++	++	++	+	±	±	±
	28	+++	++	++	±	±	±	±

[1] Oxygen content of the headspace gases was reduced by drawing 27 inches of vacuum on the containers before the samples were gassed.
+++ = Luxuriant mold growth with aerial hyphae.
++ = Marked increase in colony count or moderate mold growth without aerial hyphae.
+ = Definite growth with slight to moderate increase in colony count or a very slight mold growth.
± = The colony count remained approximately the same as the initial count or no evidence of mold growth.
− = Slight but measurable decrease in colony count from initial count.
− − = Marked decrease in colony count from initial count.

TABLE 4

The effect of pH and CO_2 pressure on the growth of microorganisms

Organism	No. of days samples incubated before examination	Media	Carbon dioxide				Nitrogen		
			Controls not gassed		Pressurized samples		Controls not gassed		Pressurized samples
			Normal pH	Growth	pH after CO_2	Growth	Adjusted pH	Growth	Growth in media adjusted pH
A. aerogenes	4	A.P.T.	6.7	++	5.6	−	5.6	++	++
C. botulinum	4	B.H.	6.9	++	5.4	±	5.4	++	+
	7	B.H.	6.9		5.4	±	5.4		++
C. butyricum	4	O.S.B.	5.5	++	5.0	±	5.0	++	++
P.A. No. 3679	4	B.H.	6.9	++	5.4	±	5.4	++	++
S. aureus	4	A.P.T.	6.7	++	5.6	±	5.6	++	++
S. cerevisiae	4	O.S.B.	5.5	++	5.0	−	5.0	++	++
Pink torula	4	O.S.B.	5.5	++	5.0	−	5.0	++	++
A. niger	28	O.S.B.	5.5	+++	5.0	±	5.0	+++	++
Penicillium from syrup	28	O.S.B.	5.5	+++	5.0	±	5.0	+++	++
Penicillium from punch	28	O.S.B.	5.5	+++	5.0	±	5.0	+++	++

+++ = Luxuriant mold growth with aerial hyphae.
++ = Marked increase in colony count or M.P.N. over initial count or moderate mold growth without aerial hyphae.
+ = Definite growth with slight to moderate increase in colony count or M.P.N. or initial count.
± = The colony count or M.P.N. remained approximately the same as the initial count.
− = Slight but measurable decrease in colony count or M.P.N. from the initial count or no evidence of mold growth.

TABLE 5

The effect of N_2O + CO_2 mixtures at 90 p.s.i.g. upon the growth of bacteria

Organism	No. of days samples incubated before examination	Controls not gassed	Mixtures used to pressurize samples							
			85% N_2O 15% CO_2		75% N_2O 25% CO_2		50% N_2O 50% CO_2		25% N_2O 75% CO_2	
			No vac.	Vac.[1]	No vac.	Vac.[1]	No vac.	Vac.[1]	No vac.	Vac.[1]
A. aerogenes	3	++	++		++		±		−	
	14						++		− −	
C. botulinum	3	++	++	++	±	±	±	±	±	±
	42				+	++	±	±	−	−
C. butyricum	4	++	±		+		±		±	
	11		++		+		−		±	
	22				++		++		±	
	42								++	
P.A. No. 3679	3	++	++	++	±	++	±	±	±	±
	7				++		±	±	±	±
	42						+	+	+	+
S. aureus	3	++	++		++		++		++	

[1] The oxygen content of the headspace gases was reduced by drawing 27 inches of vacuum on the containers before the samples were gassed.
++ = Marked increase in colony count or M.P.N. over the initial count.
+ = Definite growth with slight to moderate increase in colony count or M.P.N. over initial count.
± = The colony count or M.P.N. remained approximately the same as the initial count.
− = Slight but measurable decrease in colony count or M.P.N. from the initial count.

TABLE 6

The effect of $N_2O + CO_2$ mixtures at 90 p.s.i.g. upon the growth of fungi

Organism	No. of days samples incubated before examination	Control not gassed	Mixtures used to pressurize samples						
			85% N_2O 15% CO_2		75% N_2O 25% CO_2		50% N_2O 50% CO_2		25% N_2O 75% CO_2
			No vac.	Vac.[1]	No vac.	Vac.[1]	No vac.	Vac.[1]	No vac.
Yeast from beer	4	++	++		++		++		++
S. cerevisiae	3	++	++		++		+		+
	7						+		++
Pink torula	4	++	±		−		−		−
	7		−		− −		− −		− −
	11		− −		− −		− −		− −
A. niger	28	+++	±	±					
	28	+++	±	±	±	±			
Penicillium from syrup	28	+++	±	±					
	28	+++	±	±	±	±	±	±	
Penicillium from punch	28	+++	±	±	±	±			
	28	+++	±	±	±	±	±	±	

[1] The oxygen content of the headspace gases was reduced by drawing 27 inches of vacuum on the containers before the samples were gassed.

+++ = Luxuriant mold growth with aerial hyphae.
++ = Marked increase in colony count over initial count or moderate mold growth without aerial hyphae.
+ = Definite growth with slight to moderate increase in colony count over initial count or very slight mold growth.
± = The colony count remained approximately the same as the initial count or no evidence of mold growth.
− = Slight but measurable decrease in colony count from initial count.
− − = Marked decrease in colony count from initial count.

SUMMARY

Nitrogen did not inhibit the growth of any of the test organisms. However, when the oxygen content of the headspace gases was reduced before the containers of media were pressurized, growth of *A. niger* was inhibited.

A. niger was the only organism tested that did not grow in medium gassed with nitrous oxide. When a vacuum was drawn on the cans of media before pressurizing with nitrous oxide, none of the mold cultures grew.

Growth of the fungi was more effectively inhibited by carbon dioxide than was the growth of the bacterial cultures tested. The only fungus to grow in medium charged with carbon dioxide was the yeast from beer but this organism did not grow in the samples vacuumized before gassing.

The oxygen content of samples pressurized with carbon dioxide had no effect upon the growth of the bacteria tested. Carbon dioxide not only inhibited the growth of *A. aerogenes*, *C. botulinum*, P.A. No. 3679, *C. butyricum*, and *S. aureus*, but also reduced the number of viable cells or spores. A similar reduction in viable yeast cells also was observed.

Using mixtures of nitrous oxide and carbon dioxide, it was observed that the inhibiting concentration of carbon dioxide varies with different organisms.

Since none of the commonly used propellents inhibited all of the test organisms, it may be concluded that the thermal treatment necessary to render unrefrigerated pressurized foods "commercially sterile" will be essentially the same as for comparable foods canned in the conventional manner.

LITERATURE CITED

1. Donald, J. R., Jones, C. L., and MacLean, A. R. M. The effect of carbonation on bacteria in beverages. *Am. J. Public Health*, 14, 122–128 (1924).
2. Giggard, E. D., and Gottschall, P. B. Heat preservati[illegible] of pressure dispensed food products. *Food Technol.*, [illegible] 324–329 (1958).
3. Golding, N. S. The gas requirements of molds. II. The oxygen requirements of *Penicillium roqueforti* in the presence of nitrogen as a diluent and absence of carbon dioxide. *J. Dairy Sci.*, 23, 879–889 (1940).
4. Golding, N. S. The gas requirements of molds. III. The effect of various concentrations of carbon dioxide on the growth of *Penicillium roqueforti* in air. *J. Dairy Sci.*, 23, 891–898 (1940).
5. Hays, G. L., and Riester, D. W. Microbiological aspects of pressure packaged foods. *Soap Chem. Specialties*, 34, 113–121 (1958).
6. Insalata, N. F. CO_2 versus beverage bacteria. *Food Eng.*, 24, (8) 84–85, 190 (1952).
7. Johnson, F. H., and Lewin, I. The disinfection of *E. coli* in relation to temperature, hydrostatic pressure, and quinine. *J. Cellular Comp. Physiol.*, 28, 23–45 (1946).
8. Johnson, F. H., and Lewin, I. The influence of pressure, temperature, and quinine on the rates of growth and disinfection of *E. coli* in log growth phase. *J. Cellular Comp. Physiol.*, 28, 77–97 (1946).
9. Koser, S. A., and Skinner, W. D. Viability of colon-typhoid group in carbonated water and carbonated beverages. *J. Bacteriol.*, 7, 111–121 (1922).
10. Larson, W. P., Hartzell, T. B., and Diehl, H. S. The effect of high pressure on bacteria. *J. Infectious Diseases*, 22, 271–279 (1918).
11. Prucha, M. J., Brannon, J. M., and Ambrose, A. S. Does carbon dioxide in carbonated milk and milk products destroy bacteria? Univ. of Ill. Agr. Coll. Exp. Sta. *Circ. No. 256* (1922).
12. Ruyle, E. H., Pearce, W. E., and Hays, G. L. Prevention of mold in kettled blueberries in No. 10 cans. *Food Research*, 11, 274–279 (1946).
13. Swearingen, J. S., and Lewis, I. M. The nature and effect of CO_2 under pressure upon bacteria. *J. Bacteriol.*, 26, 201–210 (1933).
14. Whitter, L. D., Berry, J. M., and Folinazzo, J. F. The viability of *Escherichia coli* and a spoilage yeast in carbonated beverages. *Food Research*, 23, 133–142 (1958).

Microbiological Aspects of Pressure Packaged Foods. III.

The Effect of Packaging Procedures*

(Manuscript received May 7, 1959)

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RAPID EXPANSION in sales volume of pressurized products in general, and more recently of pressurized foods, suggests that certain problems in this field be considered. Most of the first food products packed in pressure containers required refrigerated storage for preservation. The increasing interest in pressurized foods which are stored at room temperature makes it necessary to focus attention on microbiological problems with respect to prevention of spoilage and assurance of wholesomeness.

The first paper of this series *(3)* stated that process requirements for the new package will be essentially the same as for similar items packed in conventional sanitary cans. As this paper pointed out, however, in practice several differences may occur. Some products may be reformulated to give characteristics better suited to pressure dispensing. The reformulated product may have a different soluble solids content or a different pH which may create conditions more favorable for microbial attack.

A second variation which makes the pressurized item unlike that in the conventional can is the presence of the valve. Problems introduced by the valve may conceivably be a real challenge under certain conditions of commercial production. Handling and assembly of valve parts, if not done under the proper sanitary conditions may introduce various microorganisms. Certain valve constructions might cause pockets to form which could become foci of contamination as the can is pressurized. Because of the slow heat conducting characteristics of the plastic valve parts, this contamination may not be destroyed by the heat process schedules employed; process temperatures cannot be increased appreciably because the plastic parts currently used are not sufficiently heat resistant.

After the food has been partially dispensed, the product remaining in the dispensing orifice becomes a potential site for microbial growth due to the possibility of bacterial ingress.

These and other factors have been previously discussed *(1, 2, 4, 6)*. In order to obtain information on some of these points, a study was made of the effect of certain packing procedures on the survival of test organisms. By examining inoculated packs of various food products, information was obtained and is reported here on two types of valves (foam and dip tube); location of the inoculum (in the valve stem or in food present in the dispensing orifice); and gassing while the product is hot vs. gassing with the product at room temperature.

MATERIALS AND METHODS

Foods. The food items tested were selected as representative of types that might be successfully marketed in pressure containers. Most of the products tested fall within the pH range which permits commercial processing at 212° F. or lower. Grape jelly, apple sauce, chocolate syrup, apple butter and coffee concentrate were used. All except the last two items were commercial (non-pressurized) products. The apple butter was reformulated by the addition of 55 ml. of water to 400 g. of a commercial material. The coffee concentrate was laboratory prepared with a soluble solids content of 39.5% and a pH range of 4.6–4.8.

Organisms. The indicator cultures used as inoculants were selected on the basis of being known or potential causes of spoilage in the production of the foods used, as well as having thermal resistances high enough to provide a reasonably severe test. For products other than coffee, a mixed spore suspension of six molds was used in most of the work. One of these molds was an extremely heat resistant *Penicillium* strain *(5)*. All cultures were grown on potato dextrose agar and orange serum agar. A mixed suspension of cells of two *Lactobacillus* cultures was also used as an inoculum for some lots of apple sauce. The coffee concentrate was inoculated with a butyric anaerobe which had been found to grow in single strength coffee.

Cl. botulinum (Types A and B) was tested as an inoculum only in the experimental coffee concentrate to explore the theoretical possibility that the particular solids content and pH of this specific concentrate might support growth.

Levels of inoculum. The level of spores or cells employed was of such an order as to provide a condition more severe than would normally be encountered commercially. The inoculum loads per container for the various test organisms were: molds, 1400 spores; butyric anaerobe, 10,000 spores; *Cl. botulinum*, 3000–5000 spores; and lactobacilli, 4000 vegetative cells.

Valves. Although two types of valves were used in this study (foam type without dip tube and viscous product type with a dip tube), the methods of inoculum application were the same for both. In one group the valve stems were inoculated with 0.05 ml. of the suspension being tested, as shown in Figure 1. The valves were then allowed to air dry overnight at 85° F. Since the cans were pressurized through the valve, it was thought that this procedure would simulate the introduction into the can during gassing of residual organisms present in the valve. In the second group, cans were filled, crimped, gassed hot, inverted for three minutes, then water cooled to approximately 70° F. A small amount of the product was then dispensed and the inoculum added to the product in the dispensing orifice, as shown in Figure 2. It was thought that this procedure would measure the ability of mold growing in the dispensing orifice to penetrate into the contents of the can.

Heat processing. Hot gassing refers to filling hot product into the can, crimping, gassing with room temperature nitrogen, inverting the hot can for three minutes, then water cooling. When cans were gassed hot, the nitrogen was added to a pressure of 120 p.s.i.g. to produce a room temperature pressure of about 100 p.s.i.g. Cool gassing indicates the container was filled and crimped hot, air cooled without inversion, and then gassed at room temperature with 100 p.s.i.g. of nitrogen. The specific type of heat processing studied for the various food products and organisms is indicated in Table 1.

* Presented at the Nineteenth Annual Meeting of the Institute of Food Technologists, May 20, 1959.

TABLE 1

Spoilage results for various inoculation and gassing variables in products pressurized with nitrogen

Site of inoculation	Test organism	Product	No. of cans	Product temperature °F.		Gassing[1] variable	Spoilage results
				Filling	Crimping		
None	None	Jelly	12	190	180	Hot	Mold growth in 1 can
None	None	Apple butter	12	190	178	Hot	None
None	None	Chocolate syrup	12	198	186	Hot	None
None	None	Apple sauce	12	200	190	Hot	None
None	None	Coffee concentrate	12	172	164	Hot	None
Valve stem	Mold suspension[2]	Jelly	24	190	186	Hot	None
Valve stem	Mold suspension[2]	Jelly	12	192	178	Cool	Mold growth in 1 can
Valve stem	Mold suspension[2]	Apple butter	24	194	184	Hot	Mold growth in 3 cans
Valve stem	Mold suspension[2]	Apple butter	12	194	182	Cool	Mold growth in 4 cans
Valve stem	Mold suspension[2]	Chocolate syrup	24	200	192	Hot	Mold growth in 1 can
Valve stem	Mold suspension[2]	Chocolate syrup	12	200	190	Cool	Mold growth in 4 cans
Valve stem	Mold suspension[2]	Apple sauce	24	200	192	Hot	None
Valve stem	Mold suspension[2]	Apple sauce	12	200	190	Cool	Mold growth in 10 cans
Valve stem	Mold suspension[2]	Coffee concentrate	12	170	164	Hot	None
Valve stem	Lactobacillus	Apple sauce	12	200	193	Hot	None
Valve stem	*Cl. botulinum*	Coffee concentrate	23	194	174	Hot	None
Valve stem	Butyric Anaerobe	Coffee concentrate	12	182	.....	Hot	None
Prod. in dispensing orifice[3]	Mold suspension	Jelly	24	190	185	Hot	None
Prod. in dispensing orifice[3]	Mold suspension	Apple butter	23	198	180	Hot	Mold growth in 4 cans
Prod. in dispensing orifice[3]	Mold suspension	Chocolate syrup	24	200	182	Hot	None
Prod. in dispensing orifice[3]	Mold suspension	Apple sauce	24	200	188	Hot	None
Prod. in can[4]	*Cl. botulinum*	Coffee concentrate	14	194	176	Hot	None
Prod. in can[4]	Butyric Anaerobe	Coffee concentrate	6	182	174	Hot	None

[1] Product temperature at time of gassing was not measured but hot variables were pressurized immediately after valves were crimped on can.
[2] Test organisms were dried on interior surfaces of valve stems before products were pressurized.
[3] Product in cans was cooled before portion was dispensed and residual food in valve stem was inoculated.
[4] Inoculum added directly into hot product in cans before valves were crimped on containers.

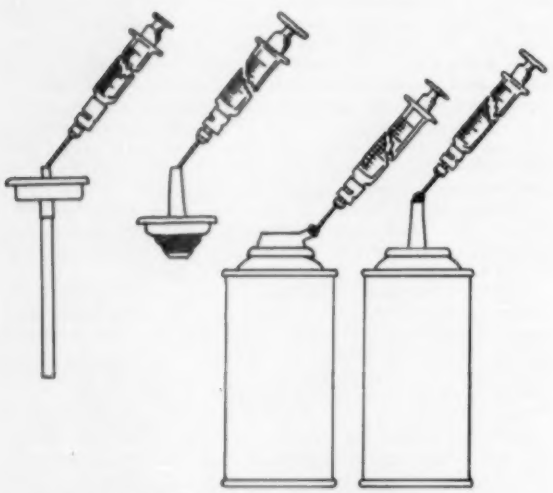

Figure 1. Inoculating the valve stem.

Figure 2. Inoculating food in the dispensing orifice.

Examination. The packs were held at 85° F. until they were examined. The coffee concentrate samples were examined after 8 months' storage. Cans of the other products were examined periodically between 2 and 6 months after packing. At the time of examination, growth of the test organisms was determined either by macroscopic examination, odor, pH change, or in the case of *Cl. botulinum*, intraperitoneal injection of the product into mice to test for the presence of toxin.

High lethality on injection of undiluted coffee concentrate was initially obtained with both unheated and heated product. The pharmacology was typical of caffeine. Opposed to this, intraperitoneal injection of inoculated pea puree prepared as a control showed typical toxin response. Ultimately it was found that a 1 to 15 dilution of the coffee concentrate could be used to test for the presence of toxin without hazard of chemical shock.

RESULTS AND DISCUSSION

The packing variables and results are summarized in Table 1. For the uninoculated controls, mold growth occurred in 1 can (jelly) out of 60. While no explanation can be offered for this finding, cross contamination is not considered a factor since the uninoculated controls were packed prior to the inoculated samples.

Of the cans inoculated with mold in the valve stem and gassed hot, 4 (3 apple butter and 1 chocolate syrup) out of 108 developed mold in the can. This compares with 19 positive (10 apple sauce, 4 chocolate syrup, 4 apple butter, and 1 jelly) out of 60 gassed cool. None of the coffee concentrate samples were gassed cool.

These data indicate that under the conditions of the test, residual organisms in the valve stem may be introduced into the canned product during gassing. There was a statistically significant difference (5% level) between hot gassing and cool gassing, with the former offering greater protection against mold growth.

Of 95 samples in which the cold product in the dispensing orifice had been inoculated, 4 (apple butter) were positive for mold in the can. Although this indicates a possibility that mold growing in the dispensing orifice may be transferred into the canned product, the heavy inoculum used admittedly represents a much more extreme condition than would be encountered in actual use.

Concerning the coffee concentrate, both the butyric anaerobe and *Cl. botulinum* were able to survive the heat treatment when the product was inoculated but no indication of growth or toxin formation was found. In a separate study, coffee concentrate at 3 soluble solids levels was inoculated with the *Cl. botulinum* and

butyric anaerobe suspensions previously described, and processed with a hot fill and 3 minute inversion, 10 minutes at 212° F., 10 minutes at 240° F., and 20 minutes at 240° F. A significant portion of this pack has been examined after 18 weeks' storage with no evidence to date of growth having occurred, based on toxicity tests or gas and odor formation.

Because of the relatively small number of cans in which mold growth occurred, not enough information was obtained to show any statistically significant difference between the two types of valves used. Of the total number of positive cans, 16 were fitted with the foam valve and 11 with the dip tube valve.

SUMMARY

Results of this work indicate that a significantly lower incidence of growth occurs when the cans are gassed while the product is still hot, compared to cans gassed after the product has cooled to room temperature. Of particular importance is the fact that it appears possible for the product to become contaminated during gassing if organisms are present in the valve stem.

No statistically significant difference in results was proved with the two types of valves employed. In view of the few cases in which mold from the product in the dispensing orifice penetrated into the can, further work on the effect of valve construction and use appears warranted.

Although the growth of test organisms in some cans may be partly explained by the high initial load and the resistant strains employed, the results suggest that the necessity for proper microbiological control in the form of good sanitation should be stressed.

LITERATURE CITED

1. Giggard, E. D., and Gottschall, P. B. Heat preservation of pressure dispensed food products. *Food Technol.*, **12**, 324–329 (1958).
2. Graham, W. E. The history and background of pressurized foods. *Food Technol.*, **12**, 317–319 (1958).
3. Hays, G. L., and Riester, D. W. Microbiological aspects of pressure packaged foods. *Soap Chem. Specialties*, **34**, 113–121 (1958).
4. Riester, D. W., Warner, R. C., and Hoffman, H. T. Packaging requirements for pressure propelled foods. *Food Technol.*, **12**, 320–324 (1958).
5. Ruyle, E. H., Pearce, W. E., and Hays, G. L. Prevention of mold in kettled blueberries in No. 10 cans. *Food Research*, **11**, 274–279 (1946).
6. Webster, R. C. How a food manufacturer can start and complete a pressurized food program. *Food Technol.*, **12**, 330–334 (1958).

An Improved Microscopic Method for Counting Ruptured Cells in Dehydrated Potato Products

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(Manuscript received May 23, 1959)

THE RELATION of gelled starch freed from broken cells to stickiness in reconstituted dehydrated potatoes was recognized over 20 years ago by Bunimowitch and Faitelowitz *(2)*. Barker and Burton *(1)* likewise observed that excessive cell rupturing and stickiness result upon reconstitution of some potato granules with boiling water. Greene *et al. (4, 5, 6)* reported that rehydrated potato granules with 20% of the cells broken were very pasty; those containing 10 or 12% broken cells were average, and those with only 6% were superior.

Various opinions have been expressed on causes of cell rupturing. These have been reviewed with reference to the influence of cooking treatments *(9, 10)*. In brief, the starch in the potato tissue swells within the confines of the cells when gelled by cooking. As swelling continues, the cell walls are distended and some of them are ruptured. Soaking raw potatoes in water heated to about 160° or 170° F. prior to cooking results in starch changes which minimize cell rupturing when the potatoes are cooked *(9)*. Hall *(7)* considered that expansion of gases during cooking and drying was a possible cause of cell rupturing. This has not been borne out by microscopic studies *(9, 10)*. However, Hall also pointed out that abrasive and other mechanical damage to the cells also may occur during certain drying treatments of potato granules and thus contribute to cell rupturing and stickiness of the reconstituted product.

Hall and Fryer *(8)* proposed a microscopic method for evaluating quality in processed potatoes by determining the percentage of broken cells in samples of 400 to 500 cells stained with iodine. They diluted the dried product directly with boiling water to form suspensions for microscopic counts. This practice is undesirable because the prescribed reconstitution of some dehydrated potato products requires addition of cold milk to the boiling water so that actual reconstitution temperature is about 170° F. Further, cell rupturing may continue during microscopic observation when boiling water is used directly in amounts necessary to prepare dilute suspensions of either cooked or dehydrated potatoes *(9)*. Counts from samples so prepared thus may not always reflect a true relation between rupturing and reconstitution qualities; also, reliable comparisons of cellular damage at different stages of manufacture cannot be made.

Investigations were undertaken to establish standard conditions of sample preparation for a more reliable evaluation of cell rupturing in products. An improved rapid method was developed and found to provide good replication for microscopic counts of ruptured cells. The method and results are described in this paper.

MATERIALS

Samples included several commercial and experimentally produced potato granule products, and freshly cooked and whipped potatoes. Comparisons were made between dried products reconstituted with boiling water and with hot water at 130° to 140° F. All freshly cooked potatoes were handled as ¾-inch slices, and both boiled and steamed potatoes were used. Cooking times were 25 and 50 minutes for the steamed potatoes and 25 minutes for the boiled. Separate samples of each cooking treatment were whipped in a mixer with a wire whip for 2 minutes at medium speed and for 5 minutes at high speed. All samples were coded and handled as unknowns for the microscopic counts.

METHOD

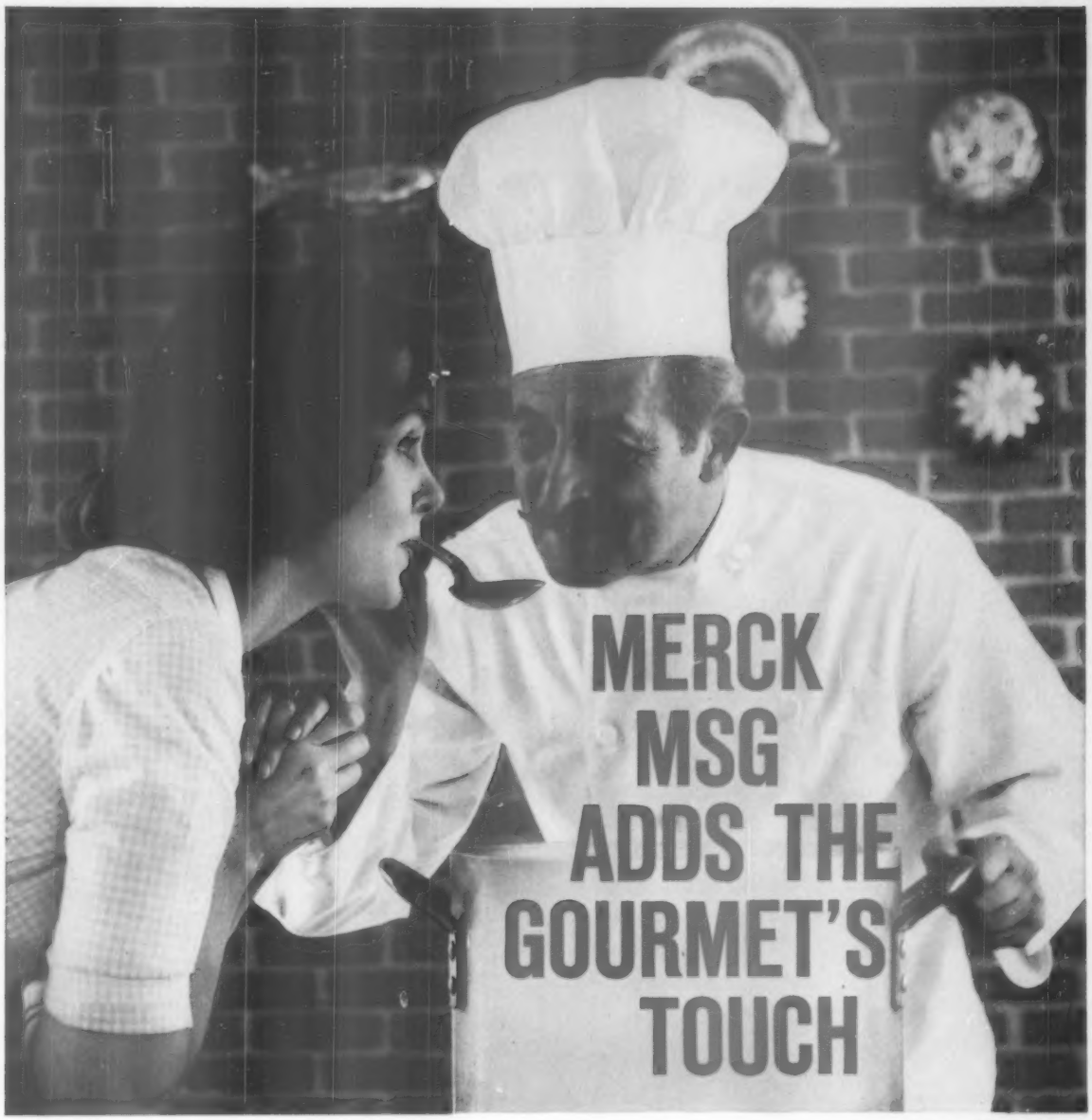
About 0.5 g. of the dehydrated product, or 1.0 g. of either the reconstituted or freshly cooked product, is wet with 3 or 4 ml. hot water (130°–140° F.) in a beaker and gently stirred. After 1 or 2 minutes 100 ml. hot water is added and the sample thoroughly mixed and then allowed to settle until the supernatant is free from air bubbles. The sample is again stirred thoroughly and while being stirred, 1 ml. of the suspension is removed with a medicine dropper and placed in a Sedgewick-Rafter counting chamber slide and a cover glass added. This slide chamber is 1 mm. deep and its capacity is 1 ml.

In the case of samples already reconstituted (and also those freshly cooked), either the dilution with hot water is delayed until the product has cooled nearly to room temperature, or dilution is made with cold water. This procedure avoids the possibility that additional cells might be ruptured by excess water and continued swelling of the gelled starch while the product is still hot.

The microscopic counts of ruptured and whole cells are made by examination of the counting-chamber sample at low magnification. An optimum range of magnifications (40X to 60X), obtainable with a 32-mm. objective in combination with a 10X, 12X, or 15X eyepiece, is preferable to the higher magnifications (100X to 150X) obtainable with a 16-mm. objective. A reticule disc having either a 7-mm. square ruled into 49 smaller squares, or one having a ruled 8-mm. circle divided into quadrants, is used in the eyepiece to define the field. Only those cells lying on and within the boundary of the defined field are counted.

The most suitable fields are those containing 30 to 90 cells, depending upon magnification. If preliminary examination consistently shows larger numbers, the same is further diluted with cold water to a particle concentration which provides an optimum range per field. At the magnifications suggested, small clusters containing up to 10 or 12 unseparated cells are sufficiently clear that the individual cells of the cluster can be counted. Fields containing larger clusters in which individual cell identification is difficult are bypassed and more suitable fields selected. A sufficient number of suitable fields not over-

* A Laboratory of the Western Utilization Research and Development Division, Agricultural Research Service, U. S. Department of Agriculture.



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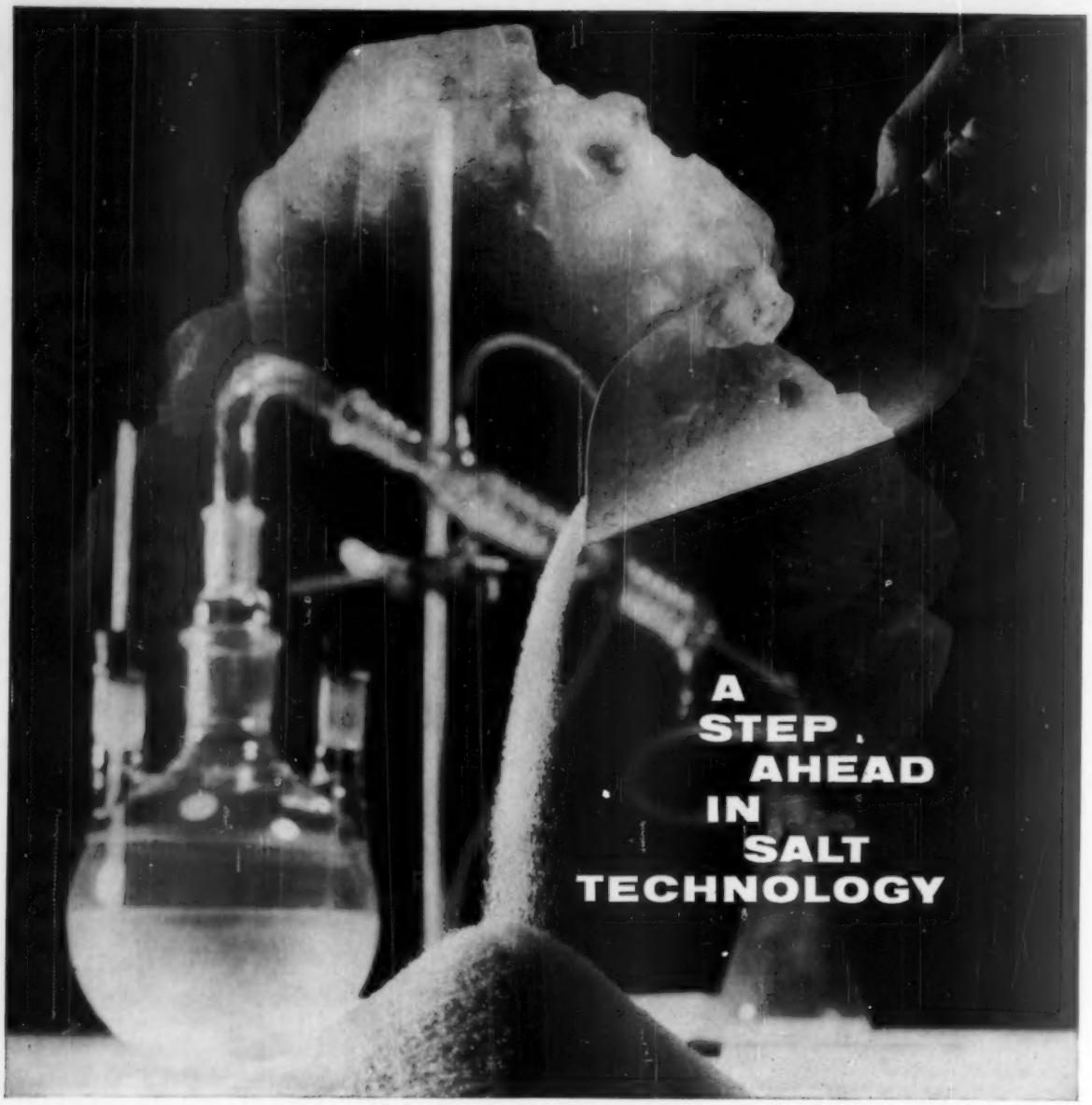

Photo montage by Loebel shows pouring of evaporated salt, distillation setup, rock salt crystal.

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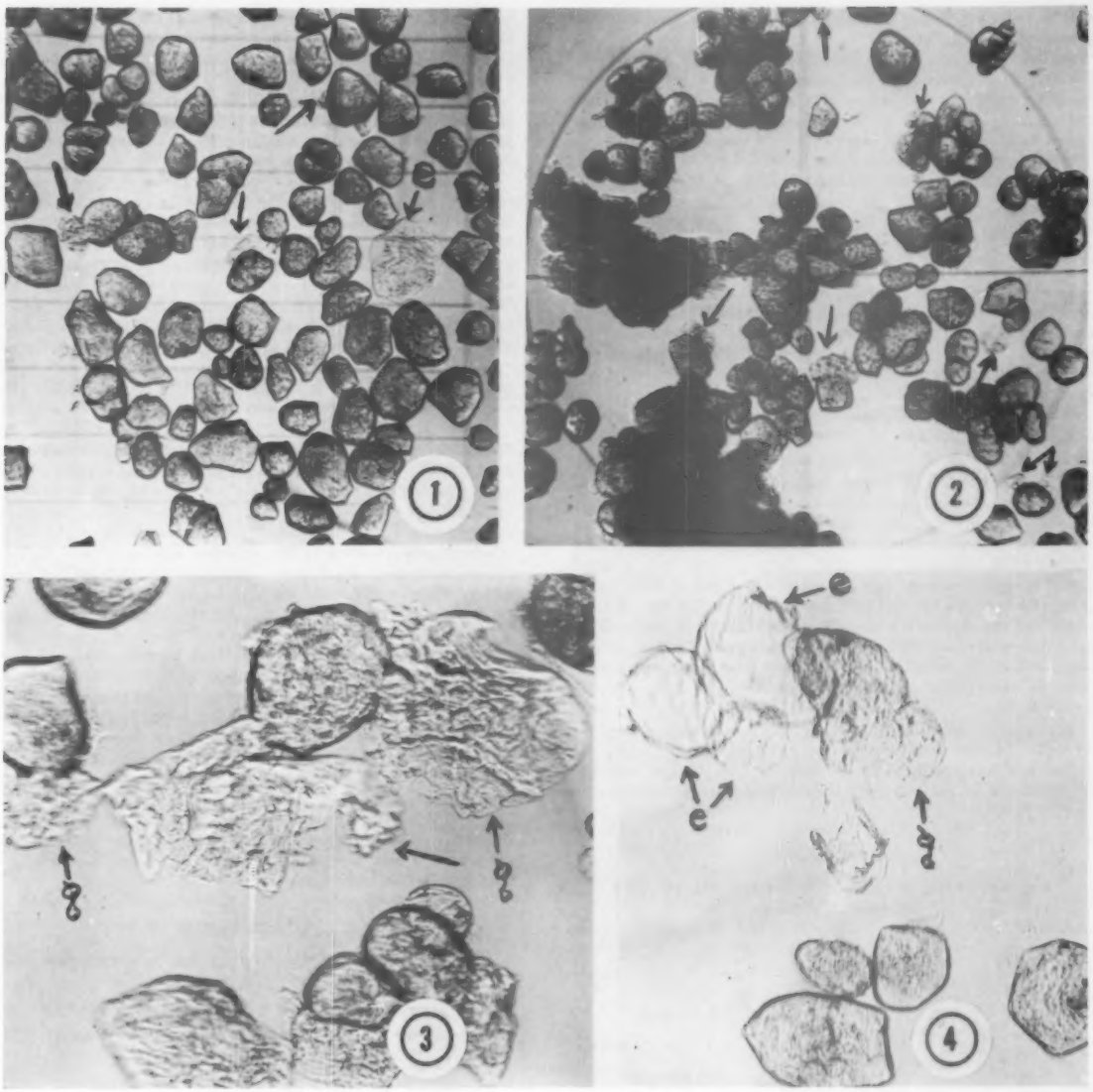

Figures 1 and 2. Photomicrographs of representative counting fields, 40X. Figure 1—with 7 mm. square reticule showing ruptured cells with extruded gelled starch (arrows) and empty cell (e). Figure 2—with 8 mm. circle reticule showing extruded gelled starch from broken cells (arrows) and large (uncounted) and small (counted) clusters of unseparated cells. Figures 1 and 2 also show differences in degree of cell separation with 2 large clusters of uncountable, unseparated cells in Figure 2. Due to photomicrographic conditions the lines of the reticules are not as sharply defined as they appear in actual microscopic observation.

Figures 3 and 4. Photomicrographs showing ruptured cells in cooked potatoes, 100 X; "g" = extruded gelled starch, "e" = empty cell. Large gelled starch masses may be observed to extrude from the cells ruptured in the cooking process, but usually only small masses are observed with rehydrated products. Most of the large masses became distributed over the intact cells during further handling and drying. Thus, when the dehydrated product is diluted and examined after reconstitution most of the extruded gelled starch observable is confined to the smaller masses which have not been dislodged from the cell.

lapping are counted from one preparation to provide a total count of 1,000 or more cells. Usually about 1,000 cells can be counted within 15 to 20 minutes. All empty or obviously torn cells and those with only small blobs of exuded gelled starch are counted as ruptured cells. Bodies of exuded gelled starch completely separated from cells are not counted—logically, broken cells would be found elsewhere to represent these.

Some of the originally cut cells from the surfaces of peeled, raw potato slices probably contribute to the ruptured-cell count of the processed product. This, however, is a constant error and, when the potato has been cooked and mashed, most of these remnants form thin, irregular cell-wall platelets not readily detected in the diluted samples at the magnifications recommended here.

Fragments of vascular tissue are ignored and only the large storage parenchyma cells of the potato are counted. The vascular tissues proper consist of very narrow, elongated cells (xylem and phloem) which make up a very small percentage of the total tissue. Usually such fragments are found with a few large parenchyma cells still attached. When only the small elongated cells are present, the fragment has a ragged appearance and

could be mistaken for a crushed parenchyma cell unless one is familiar with the difference.

In addition to the counts of ruptured and whole cells, distributions of clusters of unseparated cells as a percentage of total cellular particles can be determined readily. For such determinations, 4 or 5 slide chamber preparations may be scanned with care to avoid overlapping of the fields.

Staining of sample preparations with iodine is not only unnecessary but may obscure the details of some of the ruptured cells.

RESULTS

Representative counting fields as viewed with the two eyepiece discs are illustrated in Figures 1 and 2. Figure 1 illustrates the ease with which a defined field can be counted when the sample has been properly diluted and the potato cells in suspension are within an optimum range of concentration. The field in Figure 2 was selected to depict both large and small clusters of unseparated cells. The reticule boundaries in these figures are not as sharply defined as they appear optically because of photomicrographic conditions.

Various degrees of parenchyma cell rupturing also are illustrated in Figures 1 and 2 with both large and small blobs of gelled starch extruded from otherwise apparently intact cells in both figures and one empty cell in Figure 1. As previously described *(9)*, cell rupturing in cooked potatoes begins in thin cell-wall areas (primary wall pits) where at first only a small amount of gelled starch may be extruded. Upon further swelling of gelled starch the cell wall may be torn sufficiently that all or most of the starch is freed (Figures 3 and 4). It is therefore important for accurate counts that rehydration of the dried product be sufficient, that the separated cells no longer display a wrinkled, angular outline, and that swelling and cell rupturing do not continue during observation. When the angular appearance is evident, another diluted sample should be prepared. If full cell rehydration does not occur when the product is diluted with water at 130° or 140° F., hot water at 170° F. should be used—or the microscopic examination may be limited to a dilution of the sample diluted directly; the same product diluted after culinary reconstitution will reveal whether or not the conditions of direct dilution with excess hot water has caused excessive cell rupturing.

Table 1 compares representative counts made from cooked potatoes and from dehydrated products prepared both by direct dilution and by dilution after culinary reconstitution. Subjective texture appraisal also is listed for these products.

Results show a consistent relation between texture and cell rupture. All granules showing a slight to definite stickiness of texture when reconstituted with boiling water contained 5 to 8% of ruptured cells. Pronounced stickiness to gumminess was characteristic of all experimental granules containing upwards of 10 to 12% ruptured cells. Creamy to dry mealiness of texture was evident for all granule samples with 4% or less ruptured cells—the more mealy having the lower ruptured cell counts.

When one considers that a sample with 10% of its cells ruptured will have very nearly 10% of its intracellular starch content liberated in gelled form, relation to texture is obvious.

Table 1 also shows close agreement between counts made from dehydrated products diluted directly and the same products diluted after culinary reconstitution. In one series of counts made to check further for accuracy of this method, over 1,000 cells each were counted for 10 chamber slide preparations of the same diluted sample. The percentage of ruptured cells ranged from 3.3 to 4.1; the average was 3.5% and the deviations averaged ± 0.18%. Another test of 10 counts of approximately 500 cells each gave a range of 3.0 to 4.7% ruptured, an average of 3.5%, and the deviations averaged ± 0.41%. Variations in similar counts for samples containing greater numbers of broken cells were proportional. The numbers of broken cells usually ranged from 0 to 5 in individual fields of 30 to 80 counted cells for samples of low rupturing and from 0 to 10 or 12 in samples of 6 to 8% ruptured cells. It would appear then that rapid, routine check counts of 200 to 300 total cells could be made with reasonable reliability to determine an approximate range of cell rupturing in a product. However, in very badly damaged products such as "G" in Table 1, it is difficult to obtain an accurate count from a sample prepared after culinary reconstitution. Large aggregates of unseparated cells and excessive amounts of fine debris of freed starch interfere with recognition of ruptured cells.

TABLE 1

Per cent ruptured cells and texture in cooked and dehydrated potatoes

Sample	Preparation	Per cent ruptured cells	Texture when reconstituted
Cooked f. esh	25 min. steam; 2 min. whip, medium speed	1.8	Mealy
	25 min. boil; 2 min. whip, medium speed	3.9	Mealy-creamy
	50 min. steam; 2 min. whip, medium speed	2.3	Mealy
	25 min. steam; 5 min. whip, high speed	5.6	Slightly sticky
	50 min. steam; 5 min. whip, high speed	5.0	Slightly sticky
	25 min. boil; 5 min. whip, high speed	8.2	Sticky
Experimental granule A	Direct dilution	1.5	
	Dilution after reconstitution at 212° F.	1.9	Mealy
Experimental granule B	Direct dilution	1.7	
	Dilution after reconstitution at 212° F.	1.9	Mealy
Experimental granule C	Direct dilution	3.4	
	Dilution after reconstitution at 212° F.	3.9	Mealy-creamy
Experimental granule D	Direct dilution	3.6	
	Dilution after reconstitution at 212° F.	3.5	Mealy-creamy
Experimental granule E	Direct dilution	5.1	
	Dilution after reconstitution at 212° F.	6.9	Slightly sticky
Experimental granule F			
	Dilution after reconstitution at 212° F.	12.1	Sticky
Experimental granule G	Direct dilution	33.0	
	Dilution after reconstitution at 212° F.	25.0	Very gummy
Commercial granule A	Dilution after reconstitution at 212° F.	3.3	Mealy
Commercial granule B	Dilution after reconstitution at 212° F.	2.1	Mealy

DISCUSSION

The method described here for microscopic counts of ruptured cells is simple, rapid and accurate for samples prepared either by direct dilution of the dried products or by dilution after culinary reconstitution.

Hall and Fryer *(8)* stained potato cell suspensions with iodine in their method for ruptured cell counts. Although such staining enhances the contrast between whole and empty cells, it was found here that the cells in diluted suspension do not stain uniformly and, because overly stained starch obscures some of the ruptured cells the counts are more difficult to make. Control over quality of illumination with a ground glass and a light green or blue filter was found to provide microscopic conditions more uniform and superior to those obtainable by staining with iodine.

Hall and Fryer also stated that each cell should be studied individually to judge its status and they discussed the intervals of confidence for counts of different sample size.

The importance of ability to recognize a ruptured cell in making these counts requires emphasis. In the present method it was found expedient to count each cell showing any evidence of rupturing whether the cell was completely empty or showed only a small blob of extruded gelled starch. Naturally, the observer

should first study the material and prepare himself to be able to recognize any one of these conditions on the instant and at magnifications of 40X to 60X. The counting chamber slide used here is more suitable than an ordinary microscope slide for observation of cell suspensions. The sample also is safely protected with a cover glass and 2,000 to 3,000 total cells may be counted from 1 ml. of a relatively uniform suspension. All results from replicate counts of 1,000 cells each, whether in the same or in different counter chamber samples, were well within statistically reliable limits.

Reliable counts require good microscopy. Much depends upon suitable equipment as well as upon the experience of the observer. A microscope with a mechanical stage and a substage condenser capable of uniformly illuminating the field of a 32 mm. objective are necessary. Rapid counting is facilitated by use of an eyepiece disc having either a square or circular reticule which is not too finely divided and which does not extend beyond the central two thirds of the field of view. A suitable source of illumination such as a focusable microscope lamp equipped with ground glass and filter is important.

This method also provides reliable means for evaluating the changes in structure produced at different stages of processing. Increasing degrees of cell separation occur during mashing and granulation or drying of the product. This is significant to the comparison of ruptured cell counts in different products since the degree of cell separation will influence the obtainable percentage of ruptured cells. Partially dried mashes which contained many clusters of uncountable intact cells consistently gave counts of ruptured cells 1½ to 2 times greater than those of the corresponding finished products which contained few clusters of intact cells. In other words, as more intact separated cells were added to the total count, per cent of ruptured cells decreased.

A similar situation was found in making ruptured cell counts for potato flakes and shreds. The diluted samples prepared for counting contained many clusters of intact cells and the ruptured cell counts were comparatively high—between 5 and 7%. Such clusters, however, were soft and not large enough in the reconstituted products to cause them to be lumpy. When the diluted suspensions were stirred vigorously to effect greater cell separation (but without inducing cell rupture), few clusters of uncountable intact cells remained and the rupture cell counts were decreased to about ⅔ of the first values obtained.

These observations demonstrate that the procedure, when properly used, will provide reliable determinations of degree of cell rupturing in a variety of dehydrated potato products and has further usefulness in following changes caused at different stages of their manufacture.

SUMMARY

An improved microscopic method has been described for counting ruptured cells in processed potato products. Dehydrated samples are diluted directly with hot water (130°–140° F.), and reconstituted or cooked potatoes are diluted with either hot or cold water. An aliquot of the suspension is placed in a counting chamber slide of 1-ml. capacity and a coverglass added. Rupturing as a result of sample preparation is avoided and staining with iodine is unnecessary.

Replicate counts of 1,000 or more cells each at 40X magnification showed close agreement. Close agreement between cell rupturing and stickiness in reconstituted products also was obtained. Stitckiness increased as cell rupturing increased and was pronounced in samples with 10% or more of the cells ruptured. The method also may be used to determine distributions of separated cells and clusters of unseparated cells in products representing different stages of manufacture.

LITERATURE CITED

1. Barker, J. and Burton, W. G. Mashed potato powder. I. General characteristics and the "Brush-sieve" method of preparation. *Trans. Soc. Chem. Ind.*, 63, 169 (1944).
2. Bunimowitch, M., and Faitelowitz, A. An improved method of reducing potatoes and other starch containing vegetables to the form of a dry powder. British Patent 457088. June 10, 1936.
3. Cording, James, Jr., Willard, Miles J., Jr., Eskew, Roderick K., and Sullivan, John F. Advances in the dehydration of mashed potatoes by the flake process. *Food Technol.*, 11, 236 (1957).
4. Greene, J. W., Marburger, G. C., and Rohrman, F. A. Instant mashed potatoes from dehydrated granules. *Food Inds.*, 19, 1622 (1947).
5. Greene, J. W., Rohrman, F. A., Marburger, G. C., Honstead, W. H., Messenheimer, A. E., and Olson, B. E. Development of a potato granule process. *Chem. Eng. Prog.*, 44, 547 (1948).
6. Greene, J. W., Conrad, R. M., and Rohrman, F. A. Dehydration process for starchy vegetables, fruits and the like. U. S. Patent 2,490,431. December 6, 1949.
7. Hall, Raymond C. Mechanisms of potato cell rupture resulting from dehydration processing. (Thesis, Kansas State College, Manhattan, Kansas, 1951).
8. Hall, Raymond C., and Fryer, H. C. Consistency evaluation of dehydrated potato granules and directions for microscopic rupture count procedure. *Food Technol.*, 7, 373 (1953).
9. Reeve, R. M. Histological survey of conditions influencing texture in potatoes. I. Effects of heat treatments on structure. II. Observations on starch in treated cells. III. Structure and texture in dehydrated potatoes. *Food Research*, 19, 323, 333, 340 (1954).
10. Sterling, Clarence. Effect of moisture and high temperature on cell walls in plant tissues. *Food Research*, 20, 474 (1955).

A Resazurin Reduction Test for the Determination of Microbiological Quality of Processed Poultry[a,b]

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(Manuscript received May 5, 1959)

A RAPID TEST to distinguish between satisfactory and unsatisfactory food products on the basis of bacterial content can be a very convenient tool in quality control work. The dairy industry has used the methylene blue and resazurin tests for many years for estimating the acceptability of milk or cream. A comprehensive review of the advantages and disadvantages of these tests is given in *Standard Methods for the Examination of Dairy Products (1)*.

Admittedly, no single method is sufficiently reliable to identify the quality of borderline cases, but for the purposes of rapid determination of bacterial loads, the reduction test has been found very useful and adaptable. In recent years, interest has been shown in the development of a reduction test that could be applied to foods other than dairy products. Relatively poor correlation between numbers of microorganisms and resazurin reduction times has been reported for fresh and frozen eggs, meat and fresh and frozen vegetables *(5, 9)*. However, correlation was found to be good between plate counts and resazurin reduction time with egg pulp *(10, 11)* but difficulty with long reduction times was encountered when egg powders were used *(7)*. Resazurin reduction time has been used, within limits, to classify meat pies into three categories according to bacterial counts *(12)*. Mallmann *et al. (8)* used tetrazolium and Nacconol instead of resazurin and were able to show a relationship between reduction time for tetrazolium and numbers of "psychrophilic organisms" on poultry; however, the length of time for reduction to take place was longer than would be desirable for many purposes.

In the present study, an attempt was made to show that a correlation exists between numbers of organisms on processed poultry and resazurin reduction time and to show that such a test might find application in determining the bacterial quality of processed poultry.

MATERIALS AND METHODS

Freshly processed poultry and poultry stored from one to six days at 4° C. were sampled by swabbing 10 cm.[2] The swabs were broken into 10 ml. of 0.02% peptone water in screw cap tubes and shaken until the cotton swab was dispersed. Aliquots were removed in order to make plate counts, after which one ml. of sterile trypticase soy broth and one ml. of sterile reconstituted skim milk (5 g./100 ml.) were added to the tubes along with 1.0 ml. of resazurin. The resazurin was prepared as recommended in *Standard Methods for the Examination of Dairy Products (1)*. Trypticase soy broth and skim milk were added to the tubes after the dispersion of the cotton swab; otherwise excessive foaming occurred. Total counts of the numbers of organisms in these samples were obtained on nutrient agar. Triplicate sets of plates were made: one set was incubated at 37° C. for 48 hours, one at 30° C. for 48 hours and one at 15° C. for 96 hours.

For determination of reduction time, the tubes were placed in a covered waterbath and incubated at 30° C. Observations were made at 30-minute intervals until the resazurin was reduced to a fluorescent pink color. This pink color may be obtained for comparison purposes by heating a tube of the reduction mixture for 10 minutes at 121° C. Complete reduction of resazurin was not used as an endpoint since the time necessary to reduce the dye completely was excessively long.

RESULTS AND DISCUSSION

Although 37° C. has been recommended for the reduction test for dairy products, this temperature was not considered suitable for poultry. Many of the bacteria present on poultry and which develop during refrigerated storage are members of the genera *Pseudomonas* and *Achromobacter (2, 3, 13)*. A number of these organisms grow poorly—if at all—at 37° C.; for this reason 30° C. was selected for incubation of the reduction tubes. At temperatures below 30° C. the time required for the desired color change to occur was excessively long.

Trypticase soy broth was used for nutritive purposes; the addition of skim milk not only had nutritive value but also furnished a white background which made detection of color changes easier. The desired concentrations of the constituents were the addition of one ml. of trypticase soy broth and one ml. of resuspended dry skim milk (5 g./100 ml. water) to 9 ml. of 0.02% peptone water. Addition of amounts less than this resulted in extension of the reduction time and amounts in excess of this caused partial reduction of the dye. If necessary, the pH was adjusted but ordinarily it was already in the desired range of pH 7.0–7.2.

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[b] This investigation was supported by research grant E-1430(C3) from the National Institutes of Health, Public Health Service.

Approximately 10^4 organisms per ml. of reaction mixture were required to cause reduction of the dye within an 8-hour period. Since numbers of organisms occurring on freshly processed poultry are generally of the order of 10^4/cm.^{2} *(4, 6, 13)*, an area of 10 cm.^{2} was sampled in order to obtain the necessary numbers of organisms that would cause reduction within the desired length of time.

Some variation in reduction time was encountered when different areas on the same carcass were sampled. This reflected differences in the counts obtained from specified areas. However, the differences in reduction time seldom exceeded 60 minutes and had little influence on the final opinion on the condition of the poultry being tested. Table 1 shows average numbers of organisms recovered when samples were obtained from various areas on the same bird.

TABLE 1

Variation in counts and reduction time as related to location of sample

Bird sampled	Sampling site	Numbers of organisms/cm.^{2} (x10^3)			Reduction time at 30° C.
		37° C.[1]	30° C.[1]	15° C.[1]	
					(min.)
(1)	Wing	4.5	77	85	330
	Breast	100	130	180	360
	Thigh	48	100	170	360
	Thigh	18	70	66	390
	Leg	2.0	13	17	480
(2)	Wing	33	90	120	450
	Leg	34	40	73	480
	Leg	140	120	220	450
	Thigh	53	44	98	420
	Thigh	29	40	70	480
(3)	Thigh	1,700	190	5,700	180
	Leg	120	160	270	180
	Leg	100	180	680	180
	Back	480	28	1,000	150
	Back	1,200	360	2,700	150

[1] Temperature of incubation used to obtain total count.

Figure 1 shows the relationship between reduction times and logs of the numbers of bacteria per cm.^{2} enumerated at 15° C. Figures 2 and 3 show the same relationship when counts were made at 30° C. and 37° C. respectively. In certain instances in which two points coincided on the figures, an "x" was used instead of a dot. While counts and reduction times for each temperature were obtained from the same birds, some variation may be observed in the number of points on each graph because of the occurrence of uncountable plates. However, these differences were very small and probably would have little effect on the regression lines.

Calculation of F values showed that the regression of reduction time on numbers of organisms/cm.^{2} was significant at the 0.5% level for all temperatures. In Figure 4 the three calculated regression lines are compared. This comparison shows that temperature of incubation of the plates influenced the numbers of organisms that were recovered (Table 1). Counts made at 37° C. were nearly always lower than those made at 15° C. or 30° C. Little difference was observed between the counts obtained at 15° C. or 30° C. on fresh chicken or chicken which had been stored one

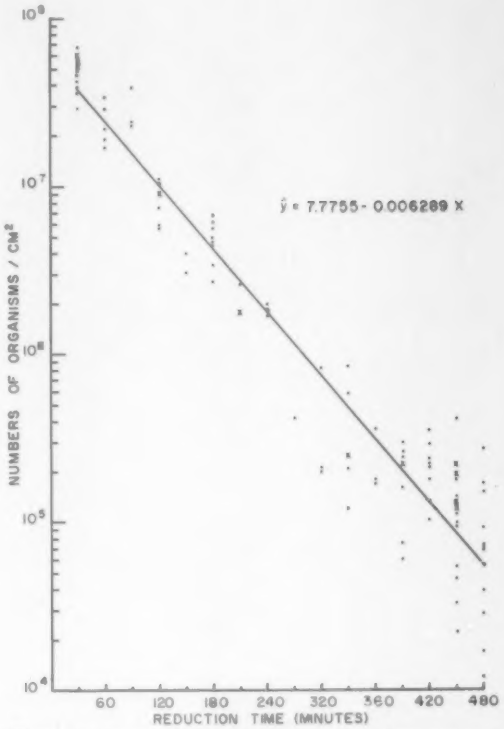

Figure 1. Regression of numbers of organisms per cm.^{2} on reduction time with total counts made at 15° C.

or two days, but as storage time at 4° C. increased, differences between the counts became evident.

There are many organisms on fresh poultry which do not persist or increase in numbers during storage at 4° C. With extension of storage time the percentage of Gram negative psychrophilic organisms increases until this group of organisms constitutes 95% or more of the total population *(3)*. The counts obtained for these reduction tests were interpreted to reflect this shift in population toward a preponderance of organisms that grow well at refrigeration temperatures. Counts were also made on plates incubated at 4° C. for 7 days. Little difference was noted between these counts and those obtained at 15° C. and so counts made at 4° C. were discontinued. In conjunction with the plate counts made at the different temperatures, Gram stains of organisms growing on the plates at 37° C. indicated 55–60% were Gram negative; at 30° C., 70–75% were Gram negative; and at 15° C., 85–90% were Gram negative.

When an attempt was made to relate reduction time to the condition of the birds, usually it was found that

TABLE 2

Relationship between condition of birds and reduction time

Condition of birds	Reduction time
	(hours)
Fresh	>8
Good	>5 but <8
Fair	>3½ but <5
Poor	<3½

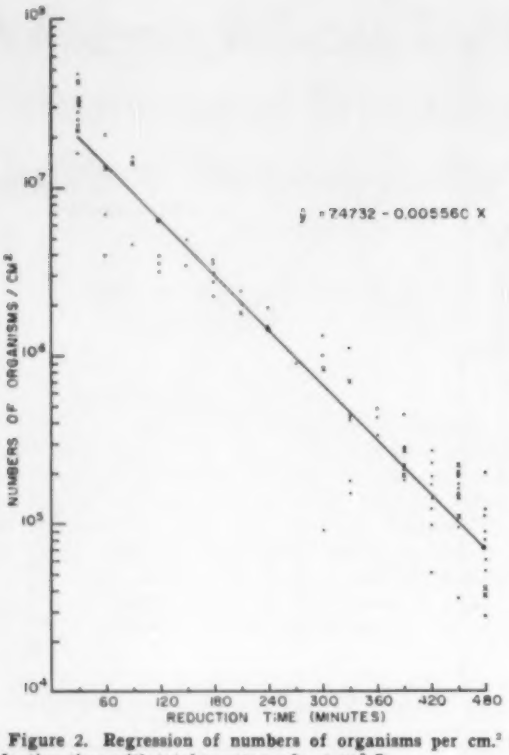

Figure 2. Regression of numbers of organisms per cm.² on reduction time with total counts made at 30° C.

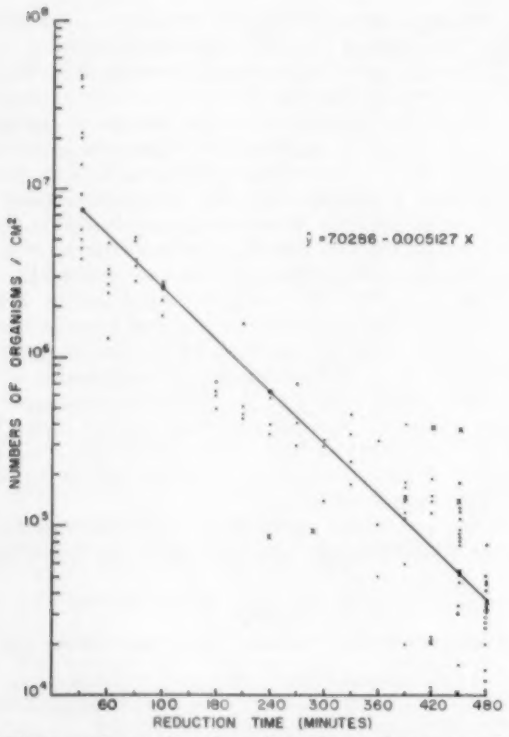

Figure 3. Regression of numbers of organisms per cm.² on reduction time with total counts made at 37° C.

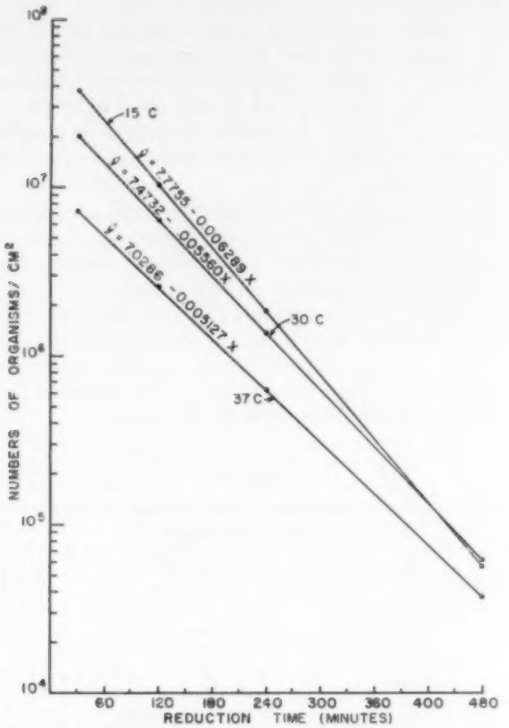

Figure 4. Comparison of the calculated regression lines obtained from counts obtained at 15°, 30° and 37° C.

birds which had been freshly processed had a reduction time of eight hours or more as shown in Table 2. Birds held in storage for one or two days had reduction times of >5 and <8 hours. As storage continued the condition of the bird became poorer which was reflected in shorter reduction times. Prediction of remaining shelf life of the product from this test might be possible if storage conditions are carefully controlled.

SUMMARY

A resazurin reduction test has been suggested for the determination of microbiological quality of processed poultry. Good correlation was found to exist between time needed to reduce the dye and numbers of organisms/cm.² of skin surface. Variations in total counts of organisms per cm.² of surface and reduction time were attributed to the location on the bird at which the sample was obtained and temperature of incubation. In general, the variations had little influence on the final evaluation of the microbiological quality of the bird, and it is suggested that this test could be used routinely for the examination of processed poultry.

LITERATURE CITED

1. American Public Health Association. *Standard Methods for the Examination of Dairy Products.* 10th ed. 1953. Am. Public Health Assoc., New York, N. Y. 345 pp.
2. Ayres, J. C., Ogilvy, W. S., and Stewart, G. F. Postmortem changes in stored meats. I. Microorganisms as-

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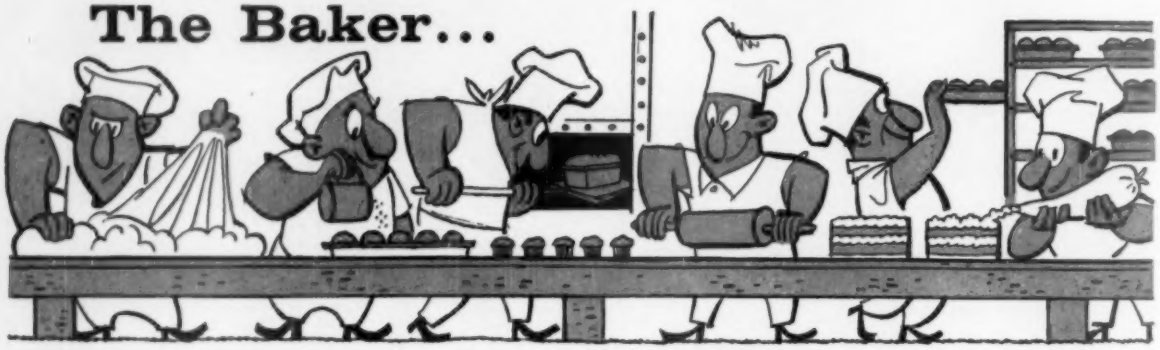

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sociated with development of slime on eviscerated cut-up poultry. *Food Technol.*, **4**, 199 (1950).
3. AYRES, J. C., WALKER, H. W., FANELLI, M. J., KING, A. W., AND THOMAS, F. Use of antibiotics in prolonging storage life of dressed chicken. *Food Technol.*, **10**, 563 (1956).
4. DREWNIAK, E. E., HOWE, M. A., GORESLINE, H. E., AND BAUSH, E. R. Studies on sanitizing methods for use in poultry processing. U.S.D.A. *Circ. No. 930* (1954).
5. FERGUSON, W. E., YATES, A. R., AND JONES, A. H. Resazurin reduction by microorganisms in fresh frozen vegetables. *Food Technol.*, **12**, 641 (1958).
6. GUNDERSON, M. R., MCFADDEN, H. W., AND KYLE, T. S. *The Bacteriology of Commercial Poultry Processing.* 1954. Burgess Publishing Co., Minneapolis, Minnesota. 98 pp.
7. JOHNS, C. K. Microbiological aspects of egg powder. *Sci. Agr.* (Ottawa), **24**, 373 (1944).
8. MALLMANN, W. L., DAWSON, L. E., SULTZER, B. M., AND WRIGHT, H. S. Studies on microbiological methods for predicting shelf-life of dressed poultry. *Food Technol.*, **12**, 122 (1958).
9. PROCTOR, B. E., AND GREENLIE, D. G. Redox potential indicators in quality control of foods. I. Correlation of resazurin reduction rates and bacterial plate counts as indices of the bacterial condition of fresh and frozen foods. *Food Research*, **4**, 441 (1939).
10. SCOTT, W. J., AND GILLESPIE, J. M. Tests for quality in egg pulp. I. A preliminary note on the application of the reductase test using resazurin as the indicator. *Australia Council Sci. Ind. Research J.*, **16**, 15 (1943).
11. SCOTT, W. J., AND GILLESPIE, J. M. Tests of quality in egg pulp. II. Further experiments on the resazurin reduction test. *Australia Council Sci. Ind. Research J.*, **17**, 299 (1944).
12. STRAKA, P. S., AND STOKES, J. L. A rapid method for the estimation of the bacterial content of precooked frozen foods. *Food Research*, **22**, 412 (1957).
13. WALKER, H. W., AND AYRES, J. C. Incidence and kinds of microorganisms associated with commercially dressed poultry. *Appl. Microbiol.*, **4**, 345 (1956).

The Interaction Between Blanching and Drying Rates of Peas[a, b, c]

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(Manuscript received May 21, 1959)

THE NECESSITY for blanching most vegetables before dehydration is well known. Such preliminary heat treatment has been found to assist in the retention of quality and nutritive value of the dehydrated product *(1, 5)*. Blanching may be carried out in either hot water, flowing steam or steam under pressure. Steam blanching has been found *(2)* to give higher yields of dehydrated vegetables having better flavor retention and resistance to browning during high temperature storage. Blanching has also been reported *(6)* to promote faster dehydration but there is little information on the extent to which drying may be accelerated by the degree of preliminary heat treatment.

In the present study, peas of varying maturity were blanched for various times in water at 210° F. and for two minutes in steam under pressures ranging from 0 to 16 pounds per square inch.

EXPERIMENTAL

The peas used were of the Perfected Freezer variety. They were harvested on successive days from the same crop so that the role of maturity might also be determined. Following vining and cleaning, the peas were size graded and peas of sizes 3, 4, 5 and 6 were washed separately before division into lots for blanching. The maturity of each lot of peas was measured in terms of their alcohol insoluble solids content. The blanched and cooled peas were then frozen and stored at −10° F. until each sample could be dried separately and the weight losses followed during dehydration. The frozen samples were thawed in air at 35° F. before passing through a mechanical slitter *(3)*. A cross-circulation type of dryer was used in which warm air was blown across the trays at velocities ranging from 900 to 1000 feet per minute. The trays were loaded at the rate of one pound per square foot and the net weight of the peas was determined initially and at frequent intervals during dehydration by means of a scale, built into the dryer. The drying temperature schedule was 200° F. Dry Bulb and 101° F. Wet Bulb for the first 20 minutes and thereafter 150° F. D.B. and 92° F. W.B. until the sample attained a weight calculated to be equivalent to a moisture content of 10%. The final moisture content of the peas as determined by the vacuum oven procedure was used as a basis for calculating the moisture controls of the peas on a dry weight basis during dehydration.

[a] Presented before the Nineteenth Annual Meeting of the Institute of Food Technologists, Philadelphia, Pa., May 19, 1959.

[b] This paper reports research undertaken in cooperation with the Quartermaster Food and Container Institute for the Armed Forces, QM Research and Engineering Command, U. S. Army, and has been assigned number 978 in the series of papers approved for publication.

[c] Journal paper No. 1173, New York State Agricultural Experiment Station, Cornell University, Geneva, New York.

The size of the samples used in each blanching trial was approximately 4500 grams. Water blanching at 210° F. for periods of 1, 2, 4 and 8 minutes, was done in a small rotary type blancher which discharged the scalded peas directly into a revolving reel where they were cooled to room temperature under sprays of cold water. Steam blanching for 2 minutes under pressures of 0, 2, 4, 8 and 16 p.s.i. was carried out by spreading the peas over the bottom of a wire basket so that the depth never exceeded 1½ inches and then placing the basket in a preheated canning retort. The blanching period began when the desired pressure and corresponding temperature was attained, which usually took 2 minutes. At the end of the blanch period, the steam was quickly exhausted from the retort, the lid removed and the peas sprayed with cold water. Similar samples were frozen without any blanching to serve as controls.

Moisture contents of the peas during dehydration were calculated in terms of $\sqrt{\frac{1}{\text{lbs. } H_2O/\text{lb. dry wt.}}}$ and these values were then related to drying time in minutes. The slope of the line of best fit obtained from this relationship was then measured as the included angle Θ *(4)*. This angle, termed the drying rate index, then represented in a single value the drying rate of the sample down to a 10% moisture level.

RESULTS AND DISCUSSION

A total of 226 samples were dehydrated and the number of samples in each blanching treatment varied from 16 to 29. The maturity of the raw peas used in each treatment ranged from 7.6 to 18.3% alcohol insoluble solids. The interaction between maturity, blanching treatment and drying rate was tested by analyses of variance. The variance among the water blanched samples was determined separately from that of the steam treatments, since the action of these blanching media on the structure and components of the peas may not be the same. In arranging the data for the variance analyses it was necessary to group the samples into the following A.I.S. ranges: 8.4–8.9, 10.0–10.7, 11.5–12.1, 13.5–14.5 and 16.0–18.3. The number of replications in each block was limited to three because drying rate data were not available beyond this number for many blanching treatments. Size grade was omitted as a variable since it is so intimately related to A.I.S. that little would be gained in trying to assess the role of size alone. The results of the analyses of variance are given in Tables 1 and 2. These analyses show in addition to the significant effect of blanching treatment on drying rate, that maturity of the raw product is also an important factor. The apparent significance of "Within % A.I.S. Range (W)" is an artifact due to the arrangement of the A.I.S. values in each replication. This was unavoidable because the A.I.S. values had to be taken as they occurred in the raw peas, and were listed in an order of increasing A.I.S.

To show the effect of water and steam blanching on drying rate, the regression lines between drying rate indices and per cent A.I.S. of the raw sample were determined and they are listed for each blanching treatment in Table 3 with correlation coefficients and probable deviations. These regression lines have been plotted in Figures 1 and 2 for the water and steam blanched samples.

TABLE 1

Analyses of variance among drying indices of water blanched peas

Source of variation	Degrees of freedom	Sum of squares	Mean sum of squares	F
Among % A.I.S. (A)	4	1,114.11	278.53	31.45**
Blanching Time (T)	4	624.83	156.21	17.64**
Within % A.I.S. Range (W)	2	137.74	68.87	7.78**
First Order Interactions				
A x W	8	46.64	5.83	0.61
A x T	16 (64)	115.66 (566.80)	7.22 (8.86)	0.76
T x W	8	98.73	12.34	1.29
Error	32	305.77	9.56	
Total	74	2,443.48		

** Denotes significance at 1% level.

TABLE 2

Analyses of variance among drying indices of steam blanched peas

Source of variation	Degrees of freedom	Sum of squares	Mean sum of squares	F
Among % A.I.S. (A)	4	97[illegible].81	244.45	31.30**
Steam Pressure (P)	4	963.13	240.78	30.83**
Within % A.I.S. Range (W)	2	144.57	72.29	9.26**
First Order Interactions				
A x W	8	179.67	22.46	3.40**
A x P	16	178.18	11.14	1.69
P x W	8 (56)	47.68 (437.42)	5.96 (7.81)	0.86
Error	32	211.56	6.61	
Total	72	2,702.60		

** Denotes significance at 1% level.

The slowest drying rates (highest drying rate indices) were obtained with the unblanched peas having high percentages of A.I.S. The younger unblanched peas appeared to dry more rapidly than the 1-minute water blanched samples but this may be part of the greater variation observed among the drying indices of the unblanched samples ($r = .70$).

Among the samples blanched in water at 210° F., the 2-minute blanch yielded much faster drying rates than the 1-minute series and to attain further speed in drying the blanching time would have to be increased to at least 8 minutes. The differences in slopes of lines for the water blanches, especially between the 1-minute and other blanching times, would indicate that somewhat greater increases in drying rate can be obtained with older peas when a more severe water blanch is used.

The greatest speed in drying rates was obtained in the steam blanched samples. There was relatively little difference in drying rate over the steam pressure range of 0 to 4 p.s.i., some increase in drying rate when the 8-p.s.i. steam pressure was used, and a very great variance in drying rate when the steam pressure was increased to 16 p.s.i. In nearly all cases, the slope

TABLE 3

Agreement between drying rate and blanching treatment

Type of blanch	No. of observations	Blanch time Min.	Steam pressure p.s.i.	Regression line equation	Coefficient of correlation	Standard error of estimate	Standard deviation
None	24	....	....	$\Theta = 45.22 + 1.16$ A.I.S.	.70	3.88	5.50
Water	29	1	....	$\Theta = 36.58 + 1.89$ A.I.S.	.94	1.97	6.15
Water	21	2	....	$\Theta = 37.20 + 1.51$ A.I.S.	.87	2.52	5.34
Water	26	4	....	$\Theta = 37.51 + 1.46$ A.I.S.	.80	3.59	6.15
Water	16	8	....	$\Theta = 39.30 + 1.22$ A.I.S.	.74	3.30	4.70
Steam	24	2	0	$\Theta = 40.51 + 1.29$ A.I.S.	.79	3.27	5.38
Steam	21	2	2	$\Theta = 39.16 + 1.36$ A.I.S.	.84	2.45	4.88
Steam	21	2	4	$\Theta = 34.15 + 1.63$ A.I.S.	.80	3.68	6.34
Steam	18	2	8	$\Theta = 39.72 + 1.08$ A.I.S.	.63	2.39	4.13
Steam	16	2	16	$\Theta = 30.30 + 1.28$ A.I.S.	.66	3.86	5.56

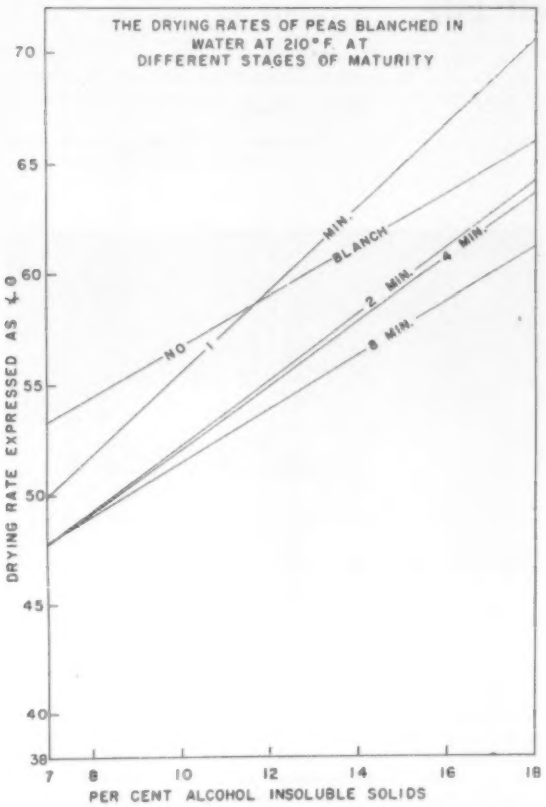
THE DRYING RATES OF PEAS BLANCHED IN WATER AT 210° F. AT DIFFERENT STAGES OF MATURITY
DRYING RATE EXPRESSED AS 1/θ
PER CENT ALCOHOL INSOLUBLE SOLIDS
NO BLANCH
1 MIN.
2 MIN.
4 MIN.
8 MIN.

Figure 1.

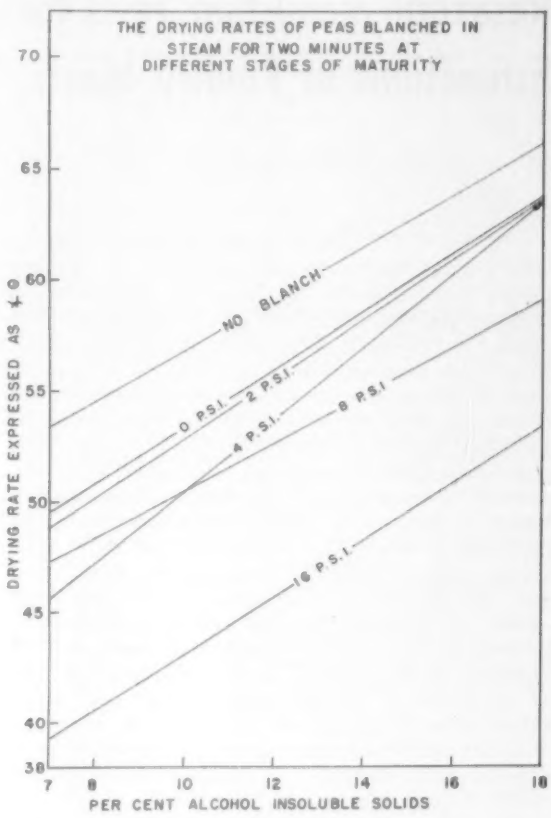
THE DRYING RATES OF PEAS BLANCHED IN STEAM FOR TWO MINUTES AT DIFFERENT STAGES OF MATURITY
DRYING RATE EXPRESSED AS 1/θ
PER CENT ALCOHOL INSOLUBLE SOLIDS
NO BLANCH
0 P.S.I.
2 P.S.I.
4 P.S.I.
8 P.S.I.
16 P.S.I.

Figure 2.

of the regression lines for the steam blanched samples was the same. Steam under pressure would appear to offer the greatest possibility for reduction of drying time by variations in blanching.

SUMMARY

Peas of the Perfected Freezer variety ranging in maturity from 7.6 to 18.3 per cent alcohol insoluble solids were blanched in water at 210° F. for 1, 2, 4 and 8 minutes or for 2 minutes in steam at 0, 2, 4, 8 and 16 p.s.i. pressure. The moisture loss from each sample was determined during dehydration and related as $\sqrt{\frac{1}{\text{lbs. } H_2O/\text{lb. dry wt.}}}$ to drying time. The slope of the line of best fit was measured as angle θ which as a single value represented the drying rate of the sample.

An analyses of variance between maturity of the raw peas, blanching treatment and drying rate showed that maturity is a governing factor with the drying rate decreasing as the peas become older. This maturity effect can be overcome in part by increasing the severity of the blanching treatment. Steam under pressure appears to offer greater possibilities than other methods for reduction of drying time by variations in blanching conditions.

LITERATURE CITED

1. Cruess, W. V., and Joslyn, M. A. Significance of enzyme reaction to dehydration of vegetables. *Proc. Inst. Food Technol.*, 99 (1942).
2. Gooding, E. G. B. The scalding of vegetables before dehydration. *Food Manuf.*, 31, 369 (1956).
3. Moyer, J. C., Robinson, W. B., Pallesen, H. R., and Hand, D. B. The effect of breaking the skin on the cross-circulation drying of peas. *Food Technol.* (in press).
4. Moyer, J. C., Pallesen, H. R., and Shallenberger, R. S. An index for expressing the cross-circulation drying rates of peas. *Food Technol.* (in press).
5. Mrak, E. M., and Mackinney, G. The dehydration of foods. *The Chemistry and Technology of Food and Food Products.* 1792 (1951). Interscience, New York.
6. Sugihara, J., and Cruess, W. V. Effect of blanching on the dehydration rates of vegetables. *Fruit Prod. J.*, 21, 139 (1942).

Resazurin Reduction Tests for Shelf Life Estimations of Poultry Meats[a,b]

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(Manuscript received April 30, 1959)

THERE IS AN APPARENT NEED for determining bacteriological condition of poultry meats in order to be able to predict shelf life and indicate the sanitary conditions under which such meats are processed. Some attempts have been made to apply dye reduction tests to determine the state of poultry meats and poultry products. Straka and Stokes *(4)* used resazurin reduction tests to evaluate bacterial content of precooked frozen foods. They established three classes which were based on correlations of bacterial numbers to reduction times and they stated the degree of predictability of these three categories from reduction tests ranged from 90 to 95%. Novak *et al. (3)* indicated that methylene blue reduction could be used with shrimp and oysters. Mallmann *et al. (2)* determined psychrophilic populations on poultry meat by use of a phytone-naccanol medium incubated at 20° C. for 72 hours. The predominance of psychrophilic populations on poultry meat under refrigeration has been previously shown by Ayres *et al. (1)* and Walker and Ayres *(5)*. Mallmann *et al. (2)* also used reduction of tetrazolium compounds as a means of estimating bacterial numbers.

This study was made to determine the relationship of resazurin reduction to population estimations on poultry and to evaluate a device for sampling a defined area of surface.

METHODS

Plate counts and sampling method. Agar plate count comparisons were made on nutrient agar containing 0.5% yeast extract. All plates were incubated for 4 days at 20° C. before counting.

Two sampling methods were compared. The first consisted of swabbing a one sq. inch area of skin by the usual swab technique except that the swabs were shaken in nutrient broth rather than buffer, saline or water. This was done in order to minimize osmotic damage to the cells. All samples were plated within 15 minutes of being taken. No increases in numbers were found to occur in this time. The second method was by surface washing. In an effort to wash an area of skin without having to use large amounts of diluents (such as total immersion of the birds) a device was developed which allowed a 1 sq. inch area of skin to be washed and the washings collected in a sterile tube. The picture of the device showing the sampler, the collection tube in place, and the syringe used to force the washing medium through the washer is shown in Figure 1. The washing chamber of the device is circular with a diameter of 1⅛ inches. It is fitted at the bottom with a rubber gasket which is placed against the surface to be sampled. The chamber is ¼ inch deep—including the thickness of the gasket. Two openings for the tubes on the top of the washing chamber connect with the chamber on the inside. As the picture shows, one of the tubes is fitted to receive the syringe and the other to hold the collection tube. This collection tube fitting is vented to reduce the compression of air when the washing medium is passed through the sampler. As the liquid in the syringe is forced into the washing chamber it enters on one side, flows over the surface exposed under the chamber and exits on the opposite side. This action results in considerable pressure. In fact, the pressure created by washing is sufficient to cause a bulging of the skin around the outside of the sampled area. The amount of washing medium used was pre-determined to give 5 or 10 ml. final volume in the collection tube. It was found that 2 ml. of liquid remained in the system so that 12 ml. of initial liquid would give a final volume of 10 ml. The metal parts were made of stainless steel so the sampler could be sterilized by immersion in 70% alcohol. This sterilization practice was carried out when samples for total counts were taken. In sampling for reduction tests, it was found that a thorough rinsing with water was sufficient and that the small contamination introduced in the reduction tubes was too small to affect the reduction times. Most any of the outside areas can be sampled although difficulty is encountered in getting to body cavity surfaces.

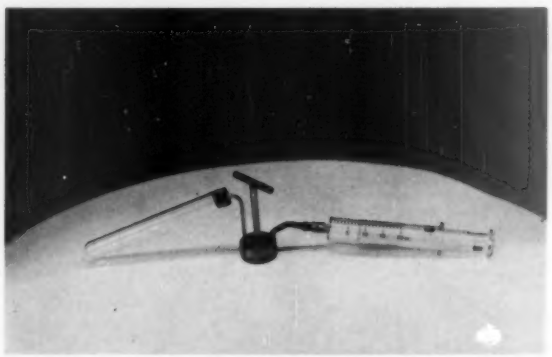

Figure 1. Surface sampling device.

Reduction tests. These tests, when made by the surface sampling device, were accomplished by washing the surface with 5 or 10 ml. of a nutrient broth-yeast extract medium. The washings were collected in a sterile tube containing 0.3 ml. (for 10 ml. washing) or 0.15 ml. (for 5 ml. washing) of a 0.05% solution of resazurin. The dye solution was made fresh every three days and stored in a refrigerator between tests. Reduction tests made by the swab method were accomplished by swabbing a 1 sq. inch area with a swab moistened with nutrient broth then breaking the swab in 5 or 10 ml. of broth-dye medium. Incubation of the tubes was done at 30° C. in the dark. Tests were read at the red end point rather than the colorless stage.

Test chickens. Test chickens were prepared by killing, scalding, warm eviscerating, halving and cooling in ice slush. After cooling, the birds were packaged by placing them in fiberboard trays and then placing the tray in a polyethylene bag. All poultry was held at 34° F. in a walk-in refrigerator, having forced air circulation. Birds which were treated with antibiotic were so treated, following chilling, by immersion for 15 minutes in solutions containing 10 p.p.m. of either chlortetracycline or oxytetracycline.

[a] Presented at the Nineteenth Annual Meeting of the Institute of Food Technologists, Philadelphia, May 19, 1959.

[b] Journal Paper No. 1400, Purdue University Agricultural Experiment Station.

RESULTS

Results of comparative counts on non-treated meat as determined by swab and surface washing are to be seen in Figure 2. Each point represents average numbers for 12 chickens. It

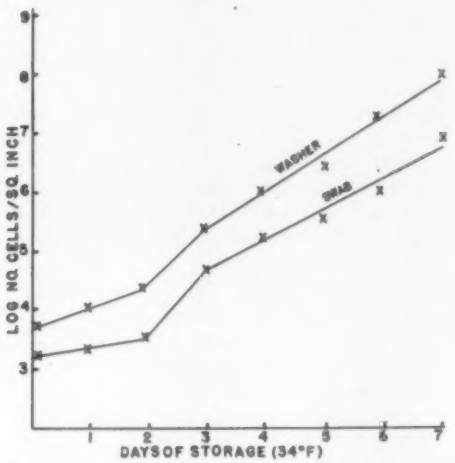

Figure 2. Determination of total bacterial numbers by swab and surface sampling techniques.

will be noticed that the counts closely parallel each other but the numbers obtained using the surface washer were higher at every sampling period. The reason may be related to the pressure developed by the washing technique. This washing under pressure would be more likely to remove bacteria from crevices (such as feather follicles) than would swabbing. A similar relationship is shown by Figure 3 which presents average re-

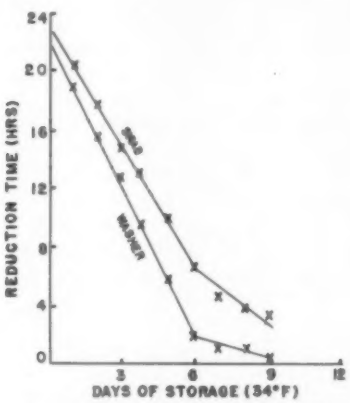

Figure 3. Average rate of reduction at different days of storage.

duction time of resazurin determined by the 2 sampling methods from the same 12 birds. The reduction time obtained by using the washed sample is consistently more rapid than that obtained by the swabbed sample. In some instances the difference in reduction time, for samples from the same birds, amounted to as much as seven hours. It should be pointed out, however, that some of this variation could have been due to variation in density of bacterial populations on various parts of the birds. From Figure 3, it is noted that the average reduction time as determined by the washer at 6 days was about 4 hours faster than that of swabbed samples and it was noted that this was the time at which odor developed in most of the birds.

TABLE 1

Individual bird differences in reduction time[1]

Bird No.	Days to odor	Reduction time at odor
2	8	5
10	8	2
11	10	2
12	10	1
4	11	2
6	11	2

[1] Selected from birds having shortest, intermediate and longest storage times.

There are variations between birds in reduction times at the time of odor development as well as variation in days to the time when odor is evident. These differences are probably due to a number of factors. In Table 1 are shown some of the variation in days to the time of odor development on some representative birds. Sampling was done with the surface washer. The table shows the days to odor and the reduction time at time of odor development of birds representing those which spoiled first, those which held longest, and those which were intermediate. It may be seen that with the exception of bird 2 the reduction times at time of off odor are all very close to the same even when the times at which odor developed were variable.

Figures 4 and 5 show the increase in bacterial numbers in relation to the decreased reduction time. Data in Figure 4 were obtained from a chicken representative of birds normally processed. Figure 5 is representative of birds similarly processed but in which the chill water was contaminated with a small amount of fecal material. The greater steepness of the curves in Figure 5 is to be noted.

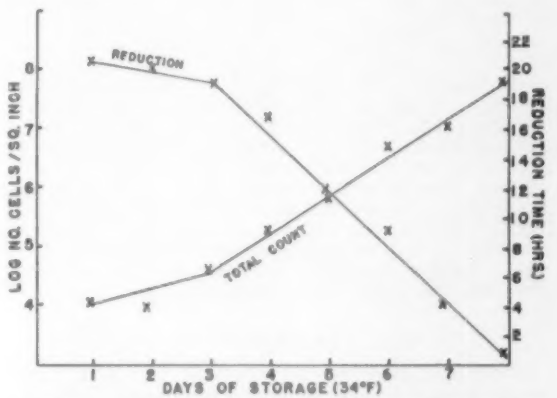

Figure 4. Reduction times and total counts of chickens chilled in ice water.

Reduction tests were also made on poultry meat which had been given antibiotic treatment to determine whether such treatment may result in altered conditions which would make reduction tests no longer useful. However, the reduction times were found to be as much a measure of microbial populations as with untreated meat and the reduction times at time of spoilage were found to be very near the averages for untreated meats (Table 2).

All the previously reported reduction tests were at 30° C. It seemed desirable to determine the effect of temperature on the rate of resazurin reduction. Straka and Stokes *(4)* found that at 37° C. reduction of resazurin by samples from meat pies was 40–50% more rapid than at 30° C. Other investigators, Ayres *et al. (1)* and Walker and Ayres *(5)* have shown psychrophilic populations to be of most importance in spoilage of poultry meats. Tests conducted at 10, 30 and 37° C. indicated that in spite of the predominant psychrophilic populations, re-

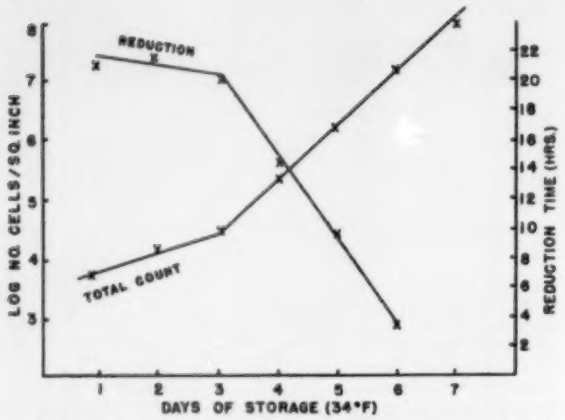

Figure 5. Reduction times and total counts of chickens chilled in fecal contaminated water.

duction times were shorter at the higher temperature when sampling was on birds which had high total numbers and were close to being spoiled. Greater differences were found when samples were from birds having low counts. In the present study no advantage and some disadvantage (greater variability) was shown on these low count samples incubated at 37° C. This could indicate that the presence of "reductases" in the washings from birds having high bacterial numbers may have been sufficient to bring about rapid reduction. In the case of low count samples, growth may be prerequisite and the higher temperature was apparently not optimum for the growth of cells most active in reducing the dye. Dye concentration within the limits of 0.1 to 0.3 ml. of dye solution per 5 ml. tubes did not affect the tests.

Several methods of preparing the nutrient medium were used. Originally 10 strength broth was prepared and 0.5 or 1.0 ml. added to each collection (depending on final volume desired) and then the tubes were sterilized. Sufficient volume of surface washings was then washed into the tubes to bring the medium to normal strength. Water was used as the washing medium. Later the method was changed so that single strength broth was used as the washing medium. Both systems worked equally well, but because of ease of use, the latter method was employed for determining the results reported here. It was also found that the addition of yeast extract to the nutrient broth appeared to allow more consistent reduction times.

DISCUSSION

Resazurin as used in these tests gave a fairly reliable means of estimating the bacteriological condition of poultry meat. Other investigators, Straka and Stokes *(4)*, have indicated that complete discoloration was the more reliable end point with resazurin systems in sampling meat pies. It may be, however, that since the systems used in these tests were essentially broth suspensions of bacterial cells the red end point was as consistent as complete discoloration. Certainly the use of the red end point reduced the time necessary to obtain a result.

TABLE 2

Effect of antibiotic treatment on reduction times

	Days to odor	Reduction time at odor
CTC treated	19	2.5
OTC treated	16	3.0
Controls	9	2.5

The greater effectiveness of the sampler may not be only in more efficient removal of bacteria, but in the carrying over into the test medium of soluble materials from the birds which may stimulate the growth of the bacterial flora or may contribute reducing substances.

The average reduction time of resazurin (with the system used) at the time of near spoilage of poultry meat is 2 hours. With storage at 34° F. the birds showed a reduction time of approximately 8 hours at the half-way point. Birds with an expected shelf-life of three times that at which they had already been held had reduction times of 12 hours or more. Thus, it seems that rather broad categories can be established which would be useful in determining expected shelf-life of fresh poultry meat. These results agree with the supposition of Mallmann *et al. (2)*, who used total washing of the birds and tetrazolium indicators, that reduction tests have a place in poultry storage testing. Resazurin apparently allows more rapid measurement of estimations than is possible with the tetrazolium compounds. More studies are needed, however, before any standards can be established. Perhaps the use of different media may give shorter reducing times. A few preliminary trials in which each chicken was sampled three times using the same washing liquid indicated that the time to reduction could be more than halved. Such a modification would allow tests to be read within the normal working day even on birds with small bacterial numbers. It seems that the described system of sampling could be easily adapted to field or plant testing.

SUMMARY

Reduction tests using both swab and wash sampling methods and resazurin dye as the indicator were studied. A device for sampling a given area of surface by washing the desired area with a sterile nutrient solution is described. The sampling device was found to be more efficient than the swab in estimating numbers of bacteria from a given area. Tests showed that with the wash sampler a reduction time of two hours or less may be expected at the near spoilage stage. The possibilities of using this test to estimate shelf-life of poultry meat are discussed.

LITERATURE CITED

1. Ayres, J. C., Ogively, W. S., and Stewart, G. F. Post mortem changes in stored meats. I. Microorganisms associated with development of slime on eviscerated cut-up poultry. *Food Technol.*, **4**, 199–205 (1950).
2. Mallmann, W. L., Dawson, L. E., Sultzer, B. M., and Wright, M. S. Studies on microbiological methods for predicting shelf life of poultry. *Food Technol.*, **12**, 122–126 (1958).
3. Novak, A. F., Fieger, E. A., and Bailey, M. E. Rapid procedures for approximation of bacterial counts in shrimp and oysters. *Food Technol.*, **10**, 66–67 (1956).
4. Straka, R. P., and Stokes, J. L. A rapid method for the estimation of the bacterial content of pre-cooked frozen foods. *Food Technol.*, **22**, 412–419 (1957).
5. Walker, H. W., and Ayres, J. C. Incidence and kinds of microorganisms associated with commercially dressed poultry. *Appl. Microbiol.*, **1**, 345–349 (1956).

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586B

Effects of Certain Pesticides on Flavor of Frozen Strawberries[a]

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College of Agriculture and Home Economics, University of Kentucky, Lexington, Ky.

(Manuscript received May 23, 1959)

THE INCREASING IMPORTANCE of strawberries as a commercial crop necessitates additional information on the application of pesticides for control of insects, mites, and diseases which attack the plants or fruit, reducing quality, and yields. Aside from the primary consideration of safety to consumers, one important question raised by the widespread use of pesticides involves the effect of these materials on the flavor of the fruit. Subjective flavor evaluation has been used *(2, 3, 4, 5, 6)* to determine whether the flavor of fruits and vegetables is altered by field application of pesticidal materials, but few workers have reported comparative tests using a variety of pesticides on a single crop.

The purpose of this study was to determine whether certain pesticides, applied as topical sprays to strawberry plants during the bearing year, imparted any objectionable off-flavors to the frozen strawberries.

This paper describes two years' flavor evaluation tests with frozen strawberries from plants sprayed with each of 21 insecticides and five fungicides. Included are methods of growing and processing the fruits, and methods and results of taste tests conducted in 1957 and 1958. The complete experiment of which this study is a part was carried out through the cooperative efforts of the Department of Entomology and Botany, the Department of Horticulture, and the School of Home Economics of the University of Kentucky College of Agriculture and Home Economics.

In addition to flavor evaluations on the frozen fruit, the experiment included studies of the biology of mites and insects attacking strawberries and the effectiveness of acaricides and insecticides in controlling these pests. Chemical residue analyses on the frozen strawberries were made by a United States Department of Agriculture research laboratory.[b]

Because fungus diseases and rots may also injure strawberries during wet years particularly, a fungicide, captan, was added to all spray materials except aramite. Captan and four other fungicides were studied separately in 1958.

EXPERIMENTAL PROCEDURE

The strawberries used in this study were grown at the University of Kentucky Agricultural Experiment Station farm in Lexington. Tennessee Beauty strawberry plants in small replicated plots were used for all treatments. Plants received three spray applications between early bloom and harvest, and the berries were harvested 1 day, 4 days, and 8 days after the last spray. In 1957, an additional harvest was taken 2 days after spraying. A complete list of spray materials and rates of application in pounds per acre appears in Tables 1, 2, and 3. All spray applications were made with stainless steel compressed-air sprayers, using flat pattern nozzles and applying 100 gallons per acre at 30 pounds pressure. It is recognized that the interval between final spraying and harvest was smaller than that recommended and also beyond a practical commercial range. In addition, some materials were included which were not currently approved for use on small fruit crops.

Processing and storage. The strawberries were picked in the early morning, taken to the Home Economics building, and frozen within 4 hours after harvesting. Control samples from untreated plots were picked and packaged at the same time as the treated harvest, using identical techniques. Fruit which was considered by the pickers to be too soft or otherwise unfit for processing was not harvested from either treated or untreated plants. The strawberries were washed, drained and capped, and packaged without added sugar in polyethylene bags. Samples were placed in frozen storage and held for 4–7 months in 1957 and for 4–6 months in 1958 before being judged for flavor.

Sensory evaluation. Samples were evaluated for flavor using the triangle test modified to include a flavor rating scale. The score sheet used was the same as that of Hogue and Briant *(5)*, except that it contained a rating scale numbered 1–10 instead of a continuum with 11 vertical divisions. The tests were conducted under subdued lighting to reduce color differences. During the second series of tests (1958), color differences were further minimized by use of small amounts of a tasteless red food coloring. Samples were puréed in a Waring blender and presented at room temperature to judges seated in individual booths. All tasting was done at midmorning. Each judge evaluated 3 sets of triangles at a sitting. A comparison of the percentages of correct separations showed that accuracy did not diminish on the third triangle. Brandt and Hutchison *(1)* found that as many as 6 trios are reliable, workable, and efficient for judging some products.

Fifteen persons, mostly staff members, served on the 1957 panel. Fourteen judges served on the 1958 panel, including 8 who had served the previous year. Tests were made only on samples harvested one day after spraying except when the number of correct separations was sufficient to indicate that a significant difference existed between the treated and untreated samples. In these instances, further tests were made using berries harvested 2 days or 4 days after the last spray, but none of these samples was judged to be significantly different from the controls.

Statistical treatment. The number of correct separations needed for significance was obtained from the Roessler, Warren, and Guymon probability tables *(7)*. Differences between adjusted average scores for treated and untreated samples in each treatment were compared by applying a *t* test. Average scores for each treatment were adjusted[c] to compensate for an

[a] The investigation reported in this paper was conducted in connection with a project of the Kentucky Agricultural Experiment Station and is published with approval of the Director.

[b] Analyses made by Mr. Jack E. Fahey, Pesticide Chemicals Research Branch, Entomology Research Division, Agricultural Research Service, U. S. D. A., Vincennes, Indiana.

[c] The average score assigned by each judge to all correctly separated samples, treated and untreated, was subtracted from the composite average of all scores assigned by all judges to correctly separated samples, resulting in a plus or minus deviation for each judge from the composite average. The deviation for each judge was added to his flavor rating score for every sample correctly separated before averaging the scores for any treatment.

TABLE 1

Results of triangle flavor evaluations of strawberries treated with pesticides—1957

Treatment [1,2]	Pounds per acre	Number days before harvest	Total number of judgments	Correct separations					Adjusted average scores	
				Total number	Number preferring					
					Treated	Untreated	No preference	Incomplete	Treated	Untreated
DDT, 50%	1.0	1	24	9	3	3	2	1	5.0	5.5
Methoxychlor, 50%	1.0	1	20	9	4	0	5		6.5	5.6[5]
TDE, 50%	1.0	1	24	10	5	1	4		5.0	4.8
Perthane, 50%	1.0	1	16	9	3	5	0	1	5.3	5.8
Thiodan, 25%	0.5	1	20	9	2	6	1		5.3	5.9
Malathion, 25%	1.0	1	22	12[3]	8	1	1	2	6.1	5.1[5]
Malathion, 25%	1.0	2	15	7	1	3	3		4.6	4.9
Malathion, 25%	1.0	4	20	10	3	4	3		5.5	5.4
Parathion, 15%	0.3	1	22	15[4]	6	6	3		5.2	5.2
Parathion, 15%	0.3	2	16	7	3	1	3		5.4	5.3
Diazinon, 25%	0.5	1	24	9	6	3	0		5.2	4.3
Guthion, 25%	0.5	1	18	10[3]	7	1	2		6.0	4.6[5]
Guthion, 25%	0.5	2	15	8	2	3	3		4.7	4.7
Demeton, 23%	0.375	1	18	9	2	2	4	1	5.2	5.4
Thimet, 25%	0.5	1	18	14[4]	5	6	3		4.8	5.1
Thimet, 25%	0.5	4	19	9	5	1	2	1	5.9	4.8
Tedion, 25%	0.25	1	20	13[4]	4	7	2		5.3	5.6
Tedion, 25%	0.25	4	20	9	2	5	2		5.3	5.6
Aramite, 15%	0.3	1	21	9	2	5	2		5.3	5.9

[1] Captan included with all treatments except aramite.
[2] All formulations are wettable powders, except demeton, which is an emulsion concentrate.
[3] Significant at the 5% level of probability.
[4] Significant at the 1% level of probability.
[5] Treated sample different from untreated $.05 \leq P \geq .01$ using t test (9).

observed tendency of some judges to use the upper end of the rating scale exclusively; others used the middle or the lower end of the scale in evaluating flavor differences. Sheppard *(8)* found that the interpretation of rating scales varies greatly among judges. The method of adjusting the scores did not change the relationship between each treatment and its control but did correct distortions in the data caused by variation in the composition of the panel from session to session.

RESULTS AND DISCUSSION

Results of the 1957 flavor evaluation tests are presented in Table 1.

Comparison of scores assigned to treated and untreated samples indicated that none of the pesticides used in 1957 imparted any detectable off-flavor to frozen strawberries. When differences were observed, the treated sample was just as likely to possess the preferred flavor as the untreated. The average score for all treated samples (5.3) and that for all untreated samples (5.2) were practically the same.

In 5 of the 13 pesticidal treatments judged in 1957, a sufficient number of correct separations was made to establish significant differentiation at the 5% level of probability or above. These were samples from plants treated one day before harvest with malathion, parathion, guthion, thimet, and tedion. The differences, however, were apparently not considered by the judges to be off-flavors because scores assigned to the treated samples were not lower than those assigned to their untreated controls. The samples treated with malathion and guthion one day before harvest were, in fact, given scores which indicated they were significantly better in flavor than the controls ($.05 \leqslant P \geqslant .01$). It is possible, then, that the pesticidal treatment used on the berries one day before harvest left some slight flavor impression which the judges found desirable. This unidentified flavor effect apparently did not persist, because the samples harvested 2 and 4 days after spraying were not judged to be better than their controls.

Results of residue analyses *(10)* showed that pesticidal residues on the samples did not exceed existing tolerances established by the Federal Food and Drug Administration.

Results of 1958 tests with insecticide-captan treatments are presented in Table 2. Again, none of the insecticides used imparted detectable off-flavors to frozen strawberries. The average score for all treated samples (6.8) and for all untreated samples (6.6) did not differ significantly, although both were higher than for the previous year.

In the 1958 tests, a significant number of correct separations was obtained on two of the nineteen insecticidal treatments judged. These were samples sprayed one day before harvest with TDE and with mitox. However, neither the number of correct separations nor the difference between scores of treated and untreated samples was sufficient to indicate that a large amount of difference existed. Again, in no instance were the untreated samples assigned scores significantly higher than the treated.

Although tedion, parathion, malathion, and guthion were retested in 1958, significant differences found in 1957 were not reproducible. TDE, tested in 1957 as well as in 1958, showed no significant difference between treated and untreated samples in 1957.

Table 3 shows the results of tests with fungicides in 1958. None of the five fungicide treated samples was judged to be significantly different from the controls. The average score for the treated samples was 6.8; for the untreated, 6.4.

Chemical analyses of residue showed that the magnitude of the residues was below 1 p.p.m. on all treatments tested in 1958 *(10)*, which was even smaller than the residues of the previous year. The small amount of residue remaining on the fruit one day after spraying is consistent with favorable organoleptic ratings assigned by judges to the treated samples in both years' tests.

TABLE 2

Results of triangle flavor evaluations of strawberries treated with pesticides—1958

Treatment [1, 2]	Pounds per acre	Number days before harvest	Total number of judgments	Correct separations					Adjusted average scores	
				Total number	Number preferring					
					Treated	Untreated	No preference	Incomplete	Treated	Untreated
DDT, 50%	1.0	1	24	11	3	5	2	1	6.6	7.0
Methoxychlor, 50%	1.0	1	24	9	5	1	3		7.4	6.3[5]
TDE, 50%	1.0	1	24	13[3]	4	6	3		7.1	7.3
TDE, 50%	1.0	4	24	8	2	3	3		5.6	6.1
Perthane, 50%	1.0	1	24	10	4	3	3		7.3	6.9
Thiodan, 25%	0.5	1	24	10	5	3	2		7.7	7.2
Malathion, 25%	1.0	1	24	12	7	1	4		6.5	6.0
Ethion, 25%	0.5	1	24	12	9	2	1		7.5	6.5
Parathion, 15%	0.3	1	24	7	4	1	2		7.7	7.0
Diazinon, 25%	0.5	1	24	12	5	4	3		6.9	6.4
Guthion, 25%	0.5	1	24	12	4	7	1		6.6	7.1
Trithion, 25%	1.0	1	24	9	3	3	3		5.9	5.8
Kelthane, 18.5%	0.37	1	24	9	3	2	3	1	6.3	6.2
Delnav, 65%	1.0	1	24	9	3	1	5		6.7	6.6
Dibrom, 64.5%	1.0	1	24	10	5	2	3		6.7	6.3
Sevin, 50%	1.0	1	24	8	2	3	3		6.2	6.7
Mitox, 40%	0.4	1	24	14[4]	4	6	3	1	6.1	6.4
Mitox, 40%	0.4	4	24	11	7	3	1		7.3	6.6
Phosphamidon, 49%	0.5	1	24	9	1	4	3	1	6.7	6.8
Tedion, 25%	0.5	1	24	8	2	3	3		6.8	7.2
Aramite, 15%	0.5	1	24	11	6	0	5		6.9	6.0

[1] Captan included with all treatments except aramite.
[2] All formulations are wettable powders, except delnav, dibrom, and phosphamidon, which are emulsion concentrates.
[3] Significant at the 5% level of probability.
[4] Significant at the 1% level of probability.
[5] Treated sample different from untreated $.05 \geq P \geq .01$ using t test (9).

Certain differences between the 1957 and 1958 tests are evident. One difference was in the number of treated samples (five) which were judged to be significantly different from their controls in 1957, compared with only two in 1958. This is probably due partly to the fact that the 1957 panel, although judging under subdued lighting, tended to be influenced by small color differences among the samples in a triangle. When this difference was overcome in the 1958 tests by use of a food coloring, the possibility of judges making correct separations by any means other than flavor differences was greatly reduced.

The composite average score for all samples was higher in 1958 than in 1957, although the slight difference in favor of the treated samples was about the same for both years. There are two possible explanations for the higher average scores assigned to all samples the second year. One is the possibility that, as the judges became more experienced and more accustomed to judging strawberries without added sugar, they tended to assign higher scores to all samples. Second, weather conditions during the 1957 harvest season were very different from those of the 1958 season, and the prevailing weather had an important influence on the kind of berries produced in both years. The Kentucky strawberry harvest season in 1957 was unusually wet, with a total of 4.22 inches of rainfall occurring on 14 days during the 34 day period from first application of pesticide to first harvest. In 1958, the harvest season was comparatively dry, with 1.03 inches of precipitation occurring on 10 days during a comparable 28 day preharvest period. Quite aside from the pesticidal treatments used, it is likely that the 1958 season produced firmer, somewhat sweeter fruit as compared with the soft, rather watery fruit of the previous year. This would have tended to raise the scores assigned by all judges to the 1958 samples, treated and untreated.

The slight over-all preference for the treated samples over the untreated in both years' tests, while not large enough to be statistically significant, may be attributed to the improvement in quality resulting from the control of insect damage to the fruit. All of the actual quality improvement resulting from insect and disease control is not apparent in the flavor evaluation data, because fruit which was soft, rotten, catfaced, or otherwise unfit for processing was not brought in from the field. Comparison of yields of acceptable fruit showed that the treated plants yielded larger quantities of acceptable fruit than did the untreated plants, on plots of the same size.

TABLE 3

Results of triangle flavor evaluations of strawberries treated with fungicides—1958

Treatment [1]	Pounds per acre	Number days before harvest	Total number of judgments	Correct separations					Adjusted average scores	
				Total number	Number preferring					
					Treated	Untreated	No preference	Incomplete	Treated	Untreated
Captan, 50%	2.0	1	24	11	5	3	2	1	6.8	6.3
Cyprex, 70%	2.1	1	24	8	3	2	2	1	6.0	6.2
Dithane, 70%	2.1	1	24	12	7	2	2	1	6.8	6.3
Dyrene, 50%	2.0	1	24	11	5	4	2		6.3	6.1
Thylate, 65%	1.95	1	24	11	7	1	3		7.3	6.7

[1] All treatments are wettable powders.

SUMMARY

In studies designed to evalute pesticides for flavor effects in 1957 and 1958, strawberries from plots sprayed with each of twenty-one insecticides and five fungicides were judged for flavor, using a modified triangular test. Under the conditions of this experiment, none of the pesticides tested imparted detectable off-flavors to frozen strawberries, even to fruit harvested one day after spraying.

In 1957, a significant number of judges were able to distinguish differences between samples treated with tedion, parathion, thimet, malathion, and guthion; but these differences were not considered to be off-flavors. In two instances where differences were observed, strawberries from plots sprayed with malathion and with guthion, harvested one day after spraying, were judged to be significantly better than the controls. Apparently these pesticidal treatments had some slight temporary flavor effect which the judges found desirable.

In 1958 tests, significant differences between treated and untreated strawberry samples were observed in those treated with TDE and with mitox. Again, the differences were apparently not off-flavors because the treated samples received flavor rating scores which were about the same as those of their controls.

None of the five fungicide-treated samples tested was judged to be significantly different from the controls.

Acknowledgment

Appreciation is expressed to all members of the taste panels, and to Dr. Dana G. Card of the Department of Agricultural Economics for his assistance with the statistical designs in the experiment.

LITERATURE CITED

1. Brandt, D. A., and Hutchison, E. P. Retention of taste sensitivity. *Food Technol.*, **10**, 419 (1956).
2. Hard, M. M., and Ross, E. Effect of Malathion on flavor of certain fruits and vegetables. *J. Agr. Food Chem.*, **2**, 20 (1954).
3. Hening, J. C., Davis, A. C., and Robinson, W. B. Flavor and color evaluations of canning crops grown on soil treated with insecticides. *Food Technol.*, **8**, 227 (1954).
4. Hinreiner, E., and Simone, M. Effects of acaracides on flavor of almonds and canned fruits. *Hilgardia*, **26**, 35 (1956).
5. Hogue, D. V., and Briant, A. M. Determining flavor differences in crops treated with pesticides. I. A comparison of a triangle and a multiple comparison method. *Food Research*, **22**, 351 (1957).
6. Olsen, R. W., Stearns, C. R., Jr., and Henrikson, R. Examination of citrus juices processed from parathion-sprayed fruit. *Food Technol.*, **6**, 350 (1952).
7. Roessler, E. B., Warren, J., and Guymon, J. F. Significance in triangular taste tests. *Food Research*, **13**, 503 (1948).
8. Sheppard, D. Descriptive terms and points systems for rating food qualities. *Food Research*, **20**, 114 (1955).
9. Snedecor, G. W. *Statistical Methods*. 5th ed., 1956. The Iowa State College Press, Ames, Iowa.
10. Unpublished data. Fahey, J. E. Pesticide Chemicals Research Branch, Entomology Research Division, Agricultural Research Service, U.S.D.A., Vincennes, Indiana.

Notes and Letters

Undergraduate Teaching in Horticulture*

Careful analysis of current trends and the opinions of acknowledged leaders in horticulture and allied industries resulted in major curricular changes in the undergraduate program at Purdue University. The new curriculum recognizes the current needs of the professional areas in horticulture and provides a balanced program of training in the basic sciences, communications, humanities, and business plus a broad understanding of agriculture. The following note should be of interest to those who have worked so painstakingly on the food technology curriculum.

Much of the vocationalism has been deleted from the courses offered in our department. The number of specific facts in our subject matter is much too great for one person to memorize and assimilate. Adding to the dilemma is the situation that with increased research findings, these vocational facts are changing very rapidly; many no doubt would be changed or obsolete by the time the student graduates and is on the job. The only possible way to teach students to cope with the infinite practical problems which they will encounter after graduation is to teach them basic principles along with examples. They should be able

* Submitted by Leslie Hafen, Associate Professor of Horticulture, Purdue University, Lafayette, Indiana.

then to apply this background of knowledge to specific problems.

DISTRIBUTION OF CREDIT HOURS

The following credits are required in the Horticultural Science option at Purdue to earn the degree of Bachelor of Science in Agriculture:

		Semester hours
1.	Mathematics	6
2.	Chemistry	14
3.	Physics	4
4.	Botany	4
5.	Zoology	4
6.	English and Speech	15
7.	Business and Economics	6
8.	Nonagricultural electives	12
9.	Freshman electives in agriculture	9
10.	Bacteriology	4
11.	Genetics	4
12.	Entomology	3
13.	Plant Physiology	4
14.	Plant Pathology	4
15.	Horticulture (Jr.-Sr. years)	15
16.	Additional electives	28

Eight-weeks employment in a horticultural industry is stipulated as "interne" experience. A total of 136 semester hours is required for graduation.

A horticultural curriculum that permits the student to graduate with essentially no botany, chemistry, mathematics, physics, bio-chemistry, plant physiology, plant pathology, genetics, and entomology is shortchanging the student. Our requirements, as shown above, safeguard the student in this respect.

Along with the increase in basic sciences, the student must be exposed to history, government, composition, speech, literature, economics, business, psychology, and sociology. Even though students may be the first to tell you they do not "need" these extra courses and that besides they would rather take another course in horticulture, they should be required to do so.

Courses are offered by the Department of Horticulture in fruit, vegetable crops, floriculture, nursery management, landscape design, and food processing. All students are assigned to the Horticultural Science option; they are no longer classified as a vegetable crops major, fruit major, floriculture major, etc. Many of the courses have been deleted or revised; new ones have been added, particularly in ornamental horticulture and landscape design.

STAFF COUNSELORS

Each student either selects or is assigned to a staff counselor. The counselor is a staff member who wants to counsel and is interested in the welfare and progress of the student. The counselor helps the students with the scheduling of their courses, advises them concerning any problem they may have and motivates them to excel in their studies and to put "academic competion" in its proper place. Approximately two counseling sessions are scheduled per semester, but the student may consult with his counselor at any time. Counseling is an extremely important and essential part of our undergraduate program.

The comment has been made from time to time, "They can't do research; so we will let them teach." This policy is wrong; qualified, highly effective teachers (even they are good research scientists) must be assigned the responsibility of developing and instructing the undergraduate courses. This past year additional staff members within the Department of Horticulture at Purdue were invited, and have consented, to teach some of the undergraduate courses. This means that the undergraduate student now has an opportunity to know, and to learn from, many more members of the staff. At the same time some of the staff members who were full-time instructors now will have a chance to do research which will make them even better teachers.

A NEW OUTLOOK

The Department has added new laboratory facilities to help illustrate the basic principles of horticulture. These facilities include additional property for growing materials for teaching and plastic greenhouses where laboratories can be conducted during the winter months.

The staff of the Department support actively the Student Horticultural Club and encourage the students to participate in this and other horticultural extracurricular activities.

Research work has expanded greatly in the Department. We have a policy of giving the Horticultural Science majors the first opportunity for employment on the research projects. Of more importance to the students than the money they have earned are their contacts with the staff, and the valuable experience they have acquired.

We feel that we have something to offer in terms of a sound program of undergraduate training in horticulture. We have strong support for this program from many different groups. We are confident that, in the not too distant future, the program will attract intelligent young men and women in increasing numbers who will be able to render productive service to the horticultural industry of our state and nation.

The Horticulture Department Staff
Purdue University
Lafayette, Indiana

The Food Additives Amendment of 1958 Viewed Objectively

MUCH DISCUSSION of the Food Additives Amendment of 1958 to the Federal Food, Drug and Cosmetic Act has taken place at the Corn Industries Research Foundation headquarters. Comments which evolved from these talks are offered for publication as a contribution toward a better understanding of the new law and, equally important in our view, of food additives.

The new amendment, which became effective March 5, 1959, is regarded by the Food and Drug Administration not only as a comprehensive insurance policy for the public health but as a positive impetus to the advance of food technology.

Until its enactment, there was no fixed responsibility to prove an additive *safe*. It was the job of the Food and Drug Administration to prove an additive *harmful*, if such were the case. The new law takes the burden of proof from FDA and places it with the food manufacturer or chemical manufacturer.

Adequate proof of safety will require pharmacological and toxicological testing of substances, on the basis of commonly accepted testing procedures. Testing of certain substances may require large numbers of animals to be on test diets for two years or more. The cost of a full-dress toxicological investigation for a new and unknown substance is estimated at around $75,000. Should the substance even be *suspected* as carcinogenic, testing periods may run as long as 7 years.

Once the food manufacturer's additive tests are completed, the Food and Drug Administration will approve, or decide otherwise. If the available toxicological data point to the necessity of restricting the substance to specific uses and/or amounts, such restrictions will be applied. If not approved, the additive will be rejected for use; in which case the food manufacturer has a right to a public hearing and the further right of appeal in court.

In effect, the new law recognizes and corrects the former unrealistic distinction between "harmful" and "safe" additives. It affirms a truth enunciated in the 16th century by the famous physician, Paracelsus: "All things are poison and nothing is innocuous. It is only the dosage by which a thing is not poison."

THE ESSENCE OF THE NEW LAW

The dosage, indeed, is the essence of the new law. The difference between safety and danger depends not on the chemical, *per se*, but on the amount of the chemical. It is at last officially recognized that many chemicals, though harmful in large doses, offer positive *improvement* to foods—in taste, color, keeping quality and other factors—and should therefore be included in foods if the inclusion is held within strict limits which are *proved* to be harmless.

Regulation applies not only to "intentional" additives—substances added directly to foods—but to "incidental" additives. The latter include any substance likely to enter food as a result of use in food processing. The law applies to food-packaging materials, irradiating processes, and residue from animal feeds which may carry over into meat, milk, and eggs.

The Food and Drug Administration has published a list of 188 additives and about 180 flavorings and seasoning agents which it *proposes* to declare safe but on which final decision has not yet been made. Additives which lack official sanction, and which have been in use prior to January 1, 1958, must receive approval within 18 months from the date of passage of the bill or their use in foods must be discontinued.

Since the cost of testing a single new additive may range from $10,000 to $75,000, it is plain that the Government's new insurance policy for the public health carries a substantial premium. It has been estimated that the food industries will spend some $20 million in the next 5 years just to clear doubts concerning some additives already in use.

Though the public has been largely unaware of it, the food industry has long been paying, through research and plant improvement, substantial premiums on public-health insurance. The great majority of manufacturers who compose this industry have been testing additives for years, satisfying themselves that the additives are safe before including them in foods. Such concern has been based, of course, on a decent and normal regard for the public health. It has been based, too, on the simple economic fact that it is good business to make and sell a product that is wholesome.

WHAT THE NEW LAW SHOULD ACCOMPLISH

What the new law should accomplish, besides public-health insurance, is public *awareness* that its health is being insured—by Government and industry alike.

To the food technologist, whether in government or industry, "additive" is a familiar word. Among laymen, however, the word is not clearly understood. Until recently, no dictionary acknowledged it as a noun. "Trace ingredient" is not a good synonym, as some additives are used in quantities which are far more than traces. An additive is of course an ingredient, but in FDA's meaning of the term it is the kind of ingredient that is proscribed from food unless it qualifies under the procedures enforced by the new law.

Additives and ingredients can be many things, and are added to foods for many reasons—to preserve, to color or flavor, to neutralize certain effects, to stabilize certain ingredients, to emulsify others, or simply to enhance the nutritive quality of a food. Because many of them have long chemical names they may arouse needless apprehension in the lay consumer mind.

Among the 360-odd additives, flavorings and seasonings which FDA proposes to declare safe, many

Aluminum Foil Packaging Plastic Film Laminations

Report No. 23 of a Series by Reynolds Metals Co.

The important functional properties of aluminum foil for packaging can obviously be supplemented by combining aluminum foil with other materials. Previous reports in this series have discussed many combinations.

The Broadest Field

The broadest field for such expansion of packaging properties is the combination of plastic films and coatings with aluminum foil. Various plastics can add heat sealability, improved flexibility, scuff resistance and greater overall durability to the protective qualities inherent in the foil alone. In fact, combinations of foil with plastic films have produced a whole new family of materials – making possible flexible packages, and also unit packages, for products which formerly could use nothing except conventional rigid containers.

Adhesive Laminating

In early developments, these combinations were achieved by adhesive laminating. This type of process is too expensive for many packaging applications even when the laminate is a simple two-layer combination. As laboratory exploration advanced into more complex structures, the cost increased – limiting the application of some materials to products requiring very special protection. During this time, and pending a solution to the economics of the problem, valuable research data was accumulated in complex laminates having many properties. These were sometimes difficult to trace to particular components, where several contributed in varying degree. But basic categories were established.

For example, combinations of polyester films with aluminum foil provide materials with exceptional strength. Reverse-printed cellulose acetate or cellophane films laminated to foil provides materials with high gloss and aesthetic properties. Saran and pliofilm in combinations with aluminum foil contribute properties of gas impermeability.

The economics of combination plastic-foil packaging was revolutionized by the development of extrusion coating. This high speed process extrudes suitable resins and polyolefins under pressure and heat directly upon the aluminum foil – to serve either as a final coating or layer of the structure, or to act as an adhesive for a further layer. Cost is much reduced, as compared to regular laminating. Therefore, this type of protection becomes available to a wide and steadily increasing variety of products.

Pilot Plant Operation

Recognizing the vast possibilities, the Reynolds Metals Company pioneered in this field. The Pilot Plant of Reynolds Research and Development Laboratory is equipped with the most modern plastic extrusion machinery – including a web carrying unit having turret unwinds, turret rewinds, an extra large cooling drum, slitting knives, and a secondary unwind to permit laminating two webs with the extruded plastic. This plant manufactures samples and evaluates all materials under carefully controlled laboratory conditions, maintaining careful records. Only by such control can the right selection for a packaging application be made and duplication of the material on the production line be assured.

Besides its Pilot Plant operation, the Reynolds Metals Company also has production extruders strategically located across the country, to supply packaging material needs after evaluation and selection.

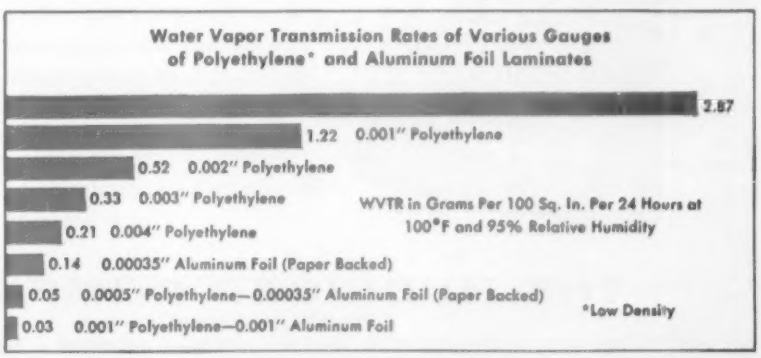
Thorough Materials Evaluation

The Pilot Plant, with its complete equipment, makes possible the thorough evaluation of all materials, including the variations in performance characteristics achieved by variations in the components. For instance, the plastic resin most frequently utilized for extrusion coating to date is polyethylene. It has the unusual properties of heat sealability at relatively low temperature, low Water Vapor Transmission Rate and chemical resistance, coupled with ease of processing. But variations in the polyethylene specification can produce a wide variety of characteristics, which must be thoroughly evaluated so that choices for particular end uses can be based on actual test data.

The accompanying chart shows how effectively even the lightest gauges of aluminum foil together with an extremely light coating of polyethylene will achieve Water Vapor Transmission Rates greatly superior to much heavier gauges of polyethylene film by itself. In addition, economies can be effected by the combination.

For Further Information

Many plastic and aluminum foil combinations originally custom made by Reynolds for particular products are now on the market. One of them may well suit your needs. Or adaptations can be developed and thoroughly tested in the Pilot Plant. For further information on this or any phase of aluminum foil packaging, call the nearest Reynolds sales office. Or write to **Reynolds Metals Company,** Richmond 18, Virginia.


Water Vapor Transmission Rates of Various Gauges of Polyethylene* and Aluminum Foil Laminates
2.87
1.22 0.001" Polyethylene
0.52 0.002" Polyethylene
0.33 0.003" Polyethylene
0.21 0.004" Polyethylene
0.14 0.00035" Aluminum Foil (Paper Backed)
0.05 0.0005" Polyethylene—0.00035" Aluminum Foil (Paper Backed)
0.03 0.001" Polyethylene—0.001" Aluminum Foil
WVTR in Grams Per 100 Sq. In. Per 24 Hours at 100°F and 95% Relative Humidity
*Low Density

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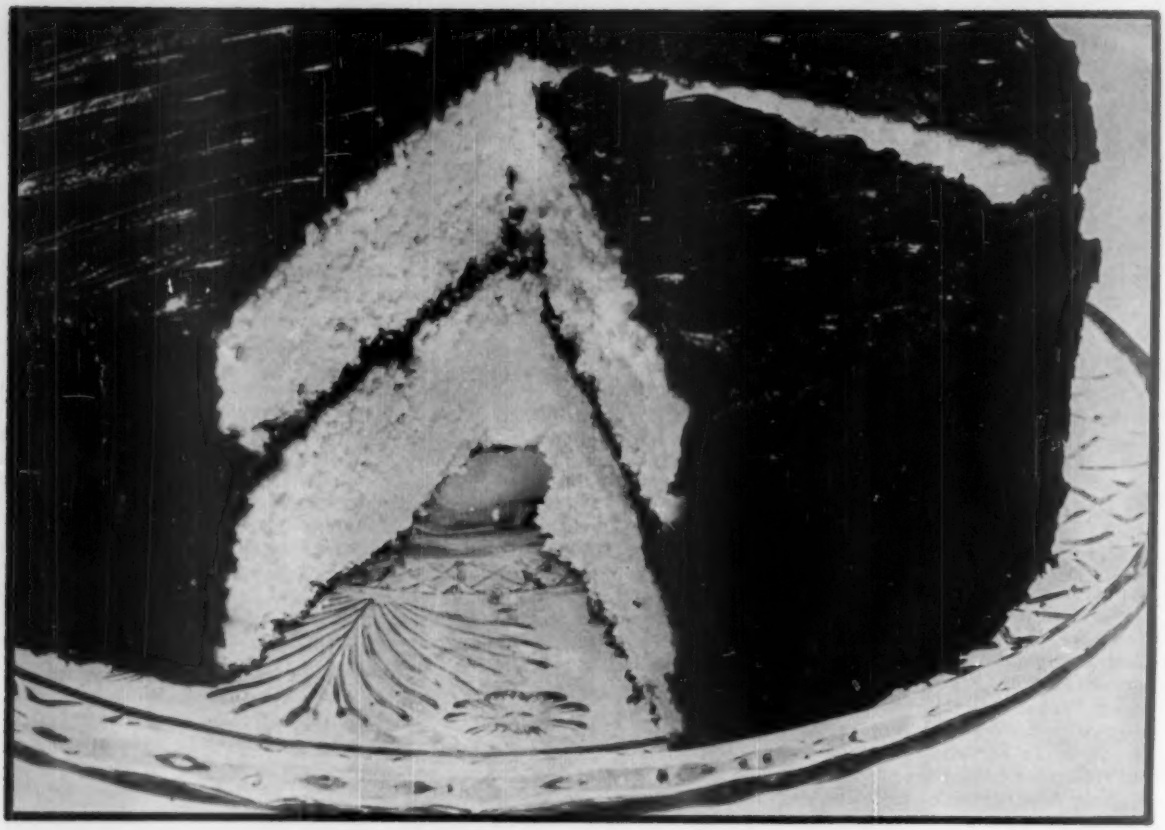

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have long chemical names. Probably several hundred others will be declared safe after the evidence from tests is in. A few, deemed safe in the past but later proved to have harmful effects over long periods of use, have been discontinued in food manufacture.

If the consumer clearly understood the word "chemical" he could live more comfortably with its application to foods. It has an unfortunate semantic hook-up with such terms as *toxic* and *poison*. Yet such chemicals as water, protein and carbohydrates are highly beneficial and, indeed, any great lack of them could mean malnutrition, starvation and even death.

According to the Food Protection Committee of the National Research Council, "There need be no hazard in the use of chemical additives provided scientific research programs are carried out prior to use. The fact that a chemical is toxic does not mean, *per se*, that its proper use as an additive will entail a hazard."

No responsible scientist would contend that absolute safety in foods can ever be achieved. On the other hand, the responsible scientists, cognizant of the facts of regulation and the efforts of industry to comply with the spirit and letter of the law, will agree that additives are essential to foods as foods are made and distributed today, and that the minimal hazard they impose is far outweighed by the good they do.

The provisions of the new law should assure the public that the utmost is being done to enforce safety. Confidence has been voiced by the men who are charged with administering the law, and by others whose integrity and concern for the public welfare are their only guide. FDA attributes the wholesomeness of foods largely to careful testing programs of the food and chemical industries for many years, and to the continuous exchange of information between industry and Government regarding new additives.

Industry has no wish to be a sacred cow on the food landscape, above reproach and immune to criticism. But despite the charges sometimes leveled against it, industry can be credited with most of the constructive work in behalf of safe and better foods—the toil, the study, and the expenditure of fortunes in research.

"THESE UNDENIABLE FACTS REMAIN"

It is easy for critics, faddists and quacks to alarm consumers with undocumented allusions to the perils in foods. But despite the prophets of poison and the attacks on industry by all the viewers-with-alarm, these undeniable facts remain:

1) Consumers everywhere in America have access to an incredibly wide choice of foods, constituting collectively the best-tasting, most varied and most wholesome diet ever enjoyed by any people; 2) the nation enjoys a generally higher level of health than ever in history; 3) dietary diseases have declined sharply and there has been a heartening increase in life-expectancy, chiefly in the past two decades—the very period that has seen an explosive increase in food additives.

People in America are eating well and feeling well.

Submitted by
WILLIAM J. HOOVER
Corn Industries Research Foundation, Inc.
Washington, D. C.

Letter to the Editor

August 24, 1959

The Editor
FOOD TECHNOLOGY

Dear Editor:

On page 20 under "Of Professional Interest" in the August number of FOOD TECHNOLOGY we were interested in the following statement: "Professor Ernest H. Wiegand, retired, who founded the nation's first food technology department at Oregon State in 1919. . . ." In this regard it is interesting to note that instruction in food technology as we think of it today was first offered at this institution in 1913. At that time Professor W. W. Chenoweth of the Pomology Department first offered formal course work in the manufacture of fruit products and the utilization of culls and surplus crops. Five years later on April 27, 1918 the Department of Horticultural Manufactures (the present Department of Food Technology) was established, with Professor W. W. Chenoweth as head, by action of the board of trustees.

Very truly yours,

W. B. ESSELEN
Head, Department of
Food Technology,
University of Massachusetts,
Amherst

Defining Minimum Moisture Contents for Dehydrated Foods*

QUICK-SERVE MEALS are under development for ration use by the Armed Forces. They consist of combinations of precooked dehydrated foods which require no preparation other than reconstitution with water *(14)*.

When the problem of moisture transfer among the components of the assembled quick-serve rations was investigated, it was found that many items absorbed water from others until their moisture content was higher than the limits set in specifications *(9)*. For several products this was undesirable and led to browning, crystallization, and caking defects. Moisture instability was especially noticeable with products high in reducing sugars or amino acids, such as tomato powder, dried onion, or soup and gravy base, when they were used in combinations in which they absorbed water. Certain products, even though they absorbed water from others until their moisture content was higher than the amount considered safe for good stability had, nevertheless, good shelf life. For example, chili con carne had satisfactory stability even though the ground beef increased in moisture from 0.6% to 3.6%. Chicken absorbed water and had better stability when combined with rice than when stored alone.

Many meat, fish, and dairy products are dehydrated to a moisture content of 3% or less. Vegetable products usually contain approximately 5% of moisture, and cereal products frequently have as much as 12%. A maximum moisture level is established for each dehydrated food separately by means of storage stability studies, but the possible existence of a minimum value for optimum stability is generally not considered.

The moisture sorption properties of a large variety of precooked dehydrated foods were determined in order to predict packaging compatibility with respect to moisture transfer *(9)*. The data have recently been re-examined with a three-fold purpose: (a) to learn whether or not there is a moisture behavior pattern common to all of the items, (b) to determine whether a minimum moisture content or vapor pressure, as well as a maximum, should be established for some items, and (c) to define a moisture range for optimum stability by reference to moisture sorption isotherms, thereby eliminating the necessity for empirical storage studies of the moisture variable.

The adsorption theory of Brunauer, Emmett and Teller (B.E.T.) *(2)* was applied to the vapor pressure data. For almost every food item it was observed that the moisture content specified for good stability agreed very closely with the amount which represented a statistical monomolecular layer of adsorbed water. Notable exceptions were chicken, ground beef, and shrimp for which the value corresponding to a monomolecular layer was significantly higher than the recommended upper limit on moisture. The chicken and ground beef were the items which apparently were not impaired, and possibly were improved, in stability by an increase in moisture content. Table 1 presents a sample of comparative moisture values for dehydrated foods representing a variety of compositions. The values which correspond to a monomolecular layer of adsorbed water computed by the B.E.T. equation agree closely with analytical moisture contents and with moisture limits in specifications.

TABLE 1

Comparison of B.E.T. monomolecular layer of adsorbed water with analytical and specification moisture contents of dehydrated precooked foods

Food item	Per cent water, as is basis		
	B.E.T. monolayer	Analytical value	Specification limit
Potato dice	5.46	5.84	6
Small red beans	4.50	4.73	4
Lima beans	5.37	3.93	4
Navy beans	5.21	3.19	4
Onion powder	3.58	4.10	4
Crackers	4.23	5.04	5
Instant macaroni	5.87	6.99	....
Instant starch	5.68	6.28	....
Dry whole milk	1.97	1.87	2.25
Nonfat dry milk	2.98	3.42	3.50
Instant nonfat dry milk	3.52	4.19	3.50
Spray dried cheese	2.22	1.82	2.50
Cocoa beverage powder	2.37	2.92	3
Beef soup and gravy base	2.38	2.78	4
Chicken soup and gravy base	1.68	2.43	4
Shrimp	5.56	3.09	2.5
Chicken[1]	5.48	1.53	1.5
Ground beef[1]	6.19[2]	0.78[2]	2.25[2]

[1] The stability of this item apparently was not impaired when it absorbed water from other components in assembled rations.
[2] Fat-free basis.

The following is the B.E.T. equation for moisture sorption isotherms:

$$\frac{p}{a\,(p_o - p)} = \frac{1}{a_1\,c} + \frac{c-1}{a_1\,c} \cdot \frac{p}{p_o} \qquad (1)$$

where a is the grams of water per 100 grams of dry solids at moisture vapor pressure p; p_o is the vapor pressure of pure water at the same temperature; c is a constant related to the heat of adsorption; and a_1 is the grams of water equivalent to a monomolecular layer adsorbed on 100 grams of dry solids. A plot of $p/a\,(p_o - p)$ against p/p_o is a straight line with y-axis intercept equal to $1/a_1\,c$ and slope equal to $(c-1)/a_1\,c$. In our work vapor pressures were expressed in terms of per cent relative humidity, R. The following transformation of the B.E.T. equation was therefore useful for the express purpose of computing a_1 values:

$$\frac{R}{a\,(100 - R)} = I + S \cdot R \qquad (2)$$

* This paper reports research undertaken by the Quartermaster Food and Container Institute for the Armed Forces, QM R&E Command, US Army, and has been assigned No. 1006 in the series of papers approved for publication.

The straight-line plot of $\frac{R}{a\,(100-R)}$ against R has y-axis intercept I and slope S. The value of the monomolecular layer can be calculated by equation (3):

$$a_1 = \frac{1}{I + 100\,S} \qquad (3)$$

The numerical values of I and S can be taken from the plot of equation (2). Alternatively they can be evaluated by solving the simultaneous equations which result from substituting into equation (2) the numerical values of a and R at two points on the isotherm between approximately 5% and 35% relative humidity.

The B.E.T. equation has frequently been applied to food materials. A few examples are its application to proteins by Shaw *(10)*, Bull *(3)*, Dunford and Morrison *(4)* and Mellon, Korn and Hoover *(8)*; to dehydrated eggs by Makower *(7)*; to rice by Hogan and Karon *(5)*; and to wheat by Becker and Sallans *(1)*. None of these applications, however, was for the purpose described here of establishing moisture levels for optimum stability.

The amount of water which represents a monomolecular layer according to the B.E.T. theory may be regarded as a protective film which protects the particles of food from attack by oxygen. There is a mass of evidence in the literature that oxidation and rancidification are aggravated by drying to very low moisure levels. Attack by oxygen is also responsible for pigment instability and loss of vitamins and sometimes initiates nonenzymatic browning reactions *(12)*. The statistical monomolecular layer may not in fact represent a continuous film but rather corresponds to the number of available reactive adsorption sites in the protein, carbohydrate and fat components of the food. When the amount of water is adequate for combining with these functional groups, they are protected from reaction with oxygen. In other terms, the relative humidity or moisture vapor pressure at this point represents a partial pressure of water vapor which is competitive with the oxygen partial pressure to the extent of being protective.

It seems reasonable that this protection should extend also to the water-holding capacity of the dehydrated food. According to Klotz and Heiney *(6)* the attachment of an oxygen molecule to a binding site of a protein would produce an incongruity in the aqueous covering sheath which could disturb the hydration structure of neighboring sites.

Competition with oxygen is not the sole basis for explaining the protective effects of water. The bond energy of the adsorbed water would inhibit interactions between polar groups on adjacent carbohydrate or protein molecules and thereby preserve rehydratability, reconstitutability and texture of the food. With respect to fat oxidation, Uri *(13)* has shown that the catalytic effect of metallic compounds is reduced when they form coordination spheres with polar groups. He considers that oxidative rancidity increases abruptly below a critical limit in the dehydration process at which the co-ordination spheres of the trace metals would be affected.

Most of the dehydrated foods exhibit S-shaped moisture sorption isotherms. The slopes and points of inflection are indicative of the water-binding capacity or of the relative amounts of free and bound water. The isotherms show hysteresis effects which are most pronounced above the point which represents completion of a monomolecular layer of water molecules. The isotherms below that point represent a region of tightly bound water having high heat of adsorption. The weak nuclear magnetic resonance absorption signal of the hydrogen nuclei of water in starch at concentrations below 6% *(11)*, which is near the monomolecular value, is indicative of the immobility of the water in this region.

If minimum moisture contents or vapor pressures for optimum stability and reconstitutability, as well as maximum values, are established by application of the principle discussed here they would provide the additional benefit of economy and increased production in the dehydration processes.

HAROLD SALWIN
Quartermaster Food and
Container Institute for the
Armed Forces, Chicago, Illinois

LITERATURE CITED

1. BECKER, H. A., AND SALLANS, H. R. A study of the desorption isotherms of wheat at 25° C. and 50° C. *Cereal Chem.*, 33, 79 (1956).
2. BRUNAUER, S., EMMETT, P. H., AND TELLER, E. Adsorption of gases in multimolecular layers. *J. Am. Chem. Soc.*, 60, 309 (1938).
3. BULL, H. B. Adsorption of water vapor by proteins. *J. Am. Chem. Soc.*, 66, 1499 (1944).
4. DUNFORD, H. B., AND MORRISON, J. L. The adsorption of water vapor by proteins. *Can. J. Chem.*, 32, 558 (1954).
5. HOGAN, J. T., AND KARON, M. L. Hygroscopic equilibria of rough rice at elevated temperatures. *J. Agr. Food Chem.*, 3, 855 (1955).
6. KLOTZ, I. M., AND HEINEY, R. E. Changes in protein topography upon oxygenation. *Proc. Nat. Acad. Sci. U. S.*, 43, 717 (1957).
7. MAKOWER, B. Vapor pressure of water adsorbed on dehydrated eggs. *Ind. Eng. Chem.*, 37, 1018 (1945).
8. MELLON, E. F., KORN, A. H., AND HOOVER, S. R. Water adsorption of proteins. *J. Am. Chem. Soc.*, 69, 827 (1947).
9. SALWIN, HAROLD, AND SLAWSON, VIDA S. Moisture transfer in combinations of dehydrated foods. Abstract of paper presented at 18th Annual Meeting of Institute of Food Technologists, Chicago, Ill. *Food Technol.*, 12 (1958).
10. SHAW, T. M. The surface area of crystalline egg albumen. *J. Chem. Phys.*, 12, 391 (1944).
11. SHAW, T. M., ELSKEN, R. H., AND KUNSMAN, C. H. Moisture determination of foods by hydrogen nuclei magnetic resonance. *J. Assoc. Offic. Agr. Chemists*, 36, 1070 (1953).
12. STADTMAN, EARL R. Nonenzymatic browning in fruit products. *Advances in Food Research*, 1, 325 (1948).
13. URI, N. Metal ion catalysis and polarity of environment in the aerobic oxidation of unsaturated fatty acids. *Nature*, 177, 1177 (1956).
14. WODICKA, VIRGIL O. Feeding the army of tomorrow. *Food Technol.*, 12, 667 (1958).

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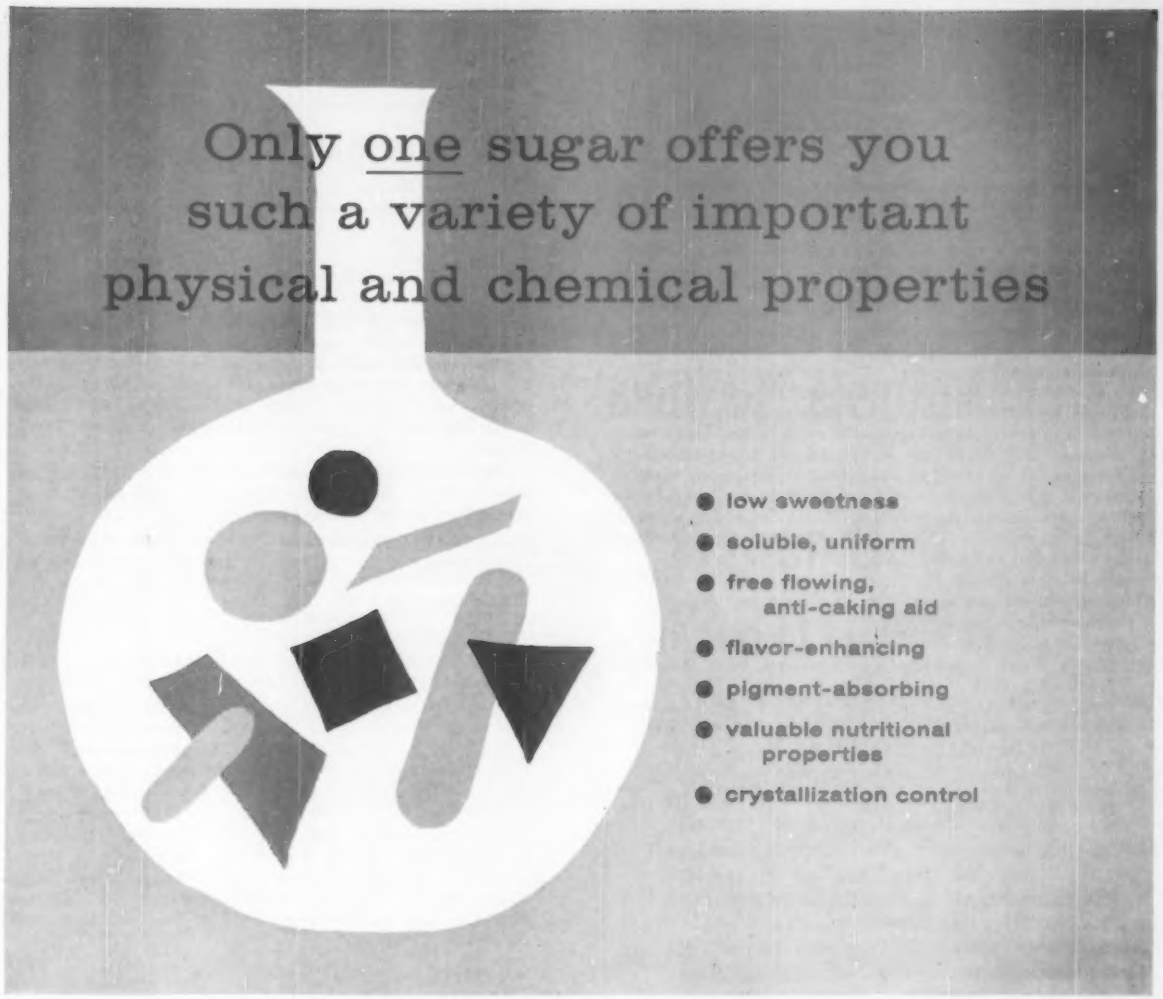

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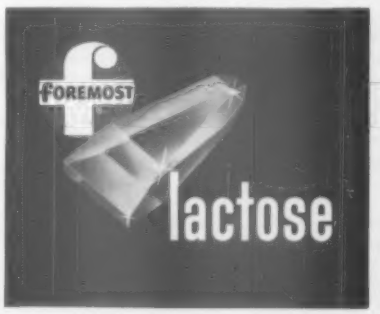

(Continued from page 31 preceding Technical Section)

Committee on Qualifications

This committee shall operate in accordance with Article IX, Section 4 of the By-Laws revised at the Council meeting in May 1959 and which reads as follows:

"Committee on Qualifications. The Committee on Qualifications shall consist of six members whose term of office shall be three years. Appointments shall be so rotated that the term of two members shall expire each year. Appointments to this committee shall be made by the president. Should any vacancies occur, they shall be filled by appointment for the unexpired terms. This committee shall examine the applications of candidates for membership and accept or reject such applications. The committee also shall determine the class of membership for which an applicant is accepted. The president may appoint as aides to the committee, one Professional Member residing in each area outside of Continental United States, in which the Institute has chartered a Regional Section, whose duties shall be to assist and advise the Committee on Qualifications on applications for membership from Food Technologists resident in his area. Three members of the Committee on Qualifications shall constitute a quorum to act on applications. The determination of the committee shall be subject to review and revision by the Council at any time."

Also refer to Article V, Sections 4 and 5 of the By-Laws which also deals with the activities of this committee.

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The responsibility of this committee is to prepare appropriate resolutions and present them at the Annual Meeting as authorized by the Executive Committee and the Council.

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Dr. Harold Schultz, Chairman, Oregon State College, Corvallis, Oregon

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Dr. Reese Vaughn

Committee on Citrus Products

1. This committee will formulate a pattern for future citrus technical sessions to be held at national meetings of the Institute. It is hoped that this pattern can be adopted either formally or informally so as to clarify just how technical papers on citrus technology will be handled.
2. Continue to push the work of the sub-committee on methodology with specific emphasis on an attempt to get some organized research on methodology into the program of various state or federal research agencies.
3. Plan a citrus technical session for the 1960 national meeting in San Francisco, providing the Program chairman of the 1960 meeting can provide space for this session.

Membership:

Mr. Charles Brokaw, Chairman, Minute Maid Corporation, 1200 W. Colonial Drive, Orlando, Florida

Mr. R. E. Cox, Vice Chairman, 404 E. Genesee Avenue, Los Angeles 36, California

Mr. Willard E. Baier — Mr. Omer McDuff
Dr. E. A. Beavens — Dr. Louis MacDowell
Mr. C. G. Beisel — Dr. W. R. Roy
Mr. Ellis Byer — Mr. George Sampson
Mr. W. R. Channell — Mr. Virgil Troy
Dr. Francis Griffiths — Mr. Howard Trumm
Mr. Homer Holton — Dr. Reese Vaughn
Mr. Robert Kilburn — Dr. Matthew Veldhuis
Dr. Fred Wenzel

Committee on Food Additives

General Objectives:

1. To collect and interpret information of both a regulatory and scientific nature on new developments and problems in the field of food additives and standards of identity as may be decided by the committee to be needed and helpful to the Institute of Food Technologists. Such material will be ordinarily disseminated through publication in Food Technology.
2. To maintain liaison with similar committees of other organizations and to assist in the development and collection of information in this field as may be necessary.
3. To provide for meetings, symposia, or round table discussions at our national meetings and upon other occasions when desirable the expansion of information and the development of understanding in this area.

Specific Objectives for 1959–1960:

1. Conducting a symposium on food additives and related problems at the annual meeting in San Francisco in 1960.
2. To promote the publication of leading articles on food additives and standards of identity in Food Technology. Specifically, we will attempt to arrange publication of some of the talks given at the Food Additives Symposium and at the Food Standards Symposium in Philadelphia in forthcoming issues of Food Technology.
3. To maintain contact with the Food Protection Committee Manufacturing Chemists Association, Flavor Extract Manufacturers Association, Industrial Food Color Group, World Health Organization and Food and Agricultural Organization and their activities related to food additives and standards of identity.

Membership:

Dr. John Mahoney, Chairman,[a] Merck & Company, 1000 Woodmere Drive, Westfield, New Jersey

Dr. John Andrews — Dr. Margaret Ives
Dr. R. L. Hall — Mr. Carl Pratt
Dr. D. B. Hand — Dr. Harold Schultz
Dr. Imri Hutchings — Dr. R. C. Sherwood
Mr. R. Thiessen

[a] The chairman of this committee is liaison representative to the Food Protection Committee of the National Research Council.

Committee on Taste Testing

The general objectives of this committee are:

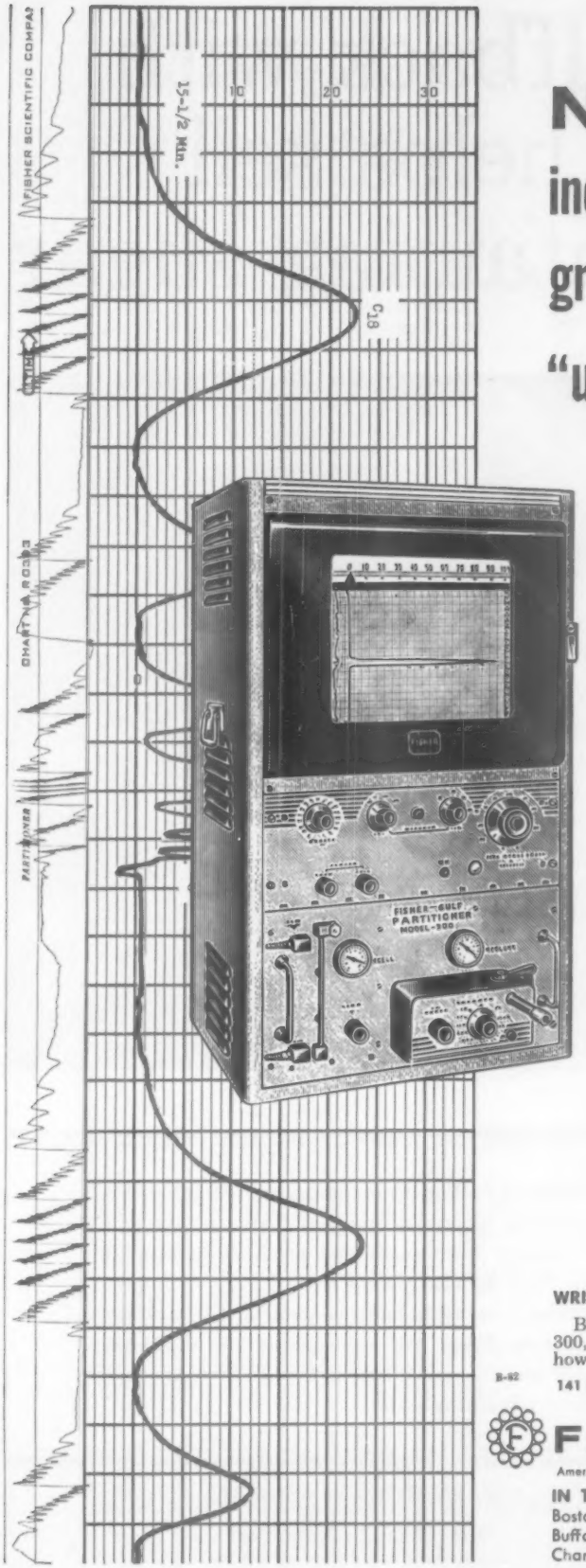
1. To bring order out of chaos in this field where empiricism is rampant, definitions and terminology need to be established, methodology needs to be screened, evaluated and developed, and the results of such tests need to be interpreted in significant terms.
2. To keep work in this field before business organizations and the public in order to impart to it stature and prestige.
3. To encourage research effort in this field and to point out those sub-areas which are most urgently in need of research.

The specific objectives for 1959–1960 are:

1. Secure publication of the glossary of terms used in sensory evaluation.
2. Proceed with the development of a "codex" for classification of sensory panels.

Membership:

Dr. H. L. Stier, Chairman, National Canners Association, 1133 20th St., N. W., Washington, D. C.



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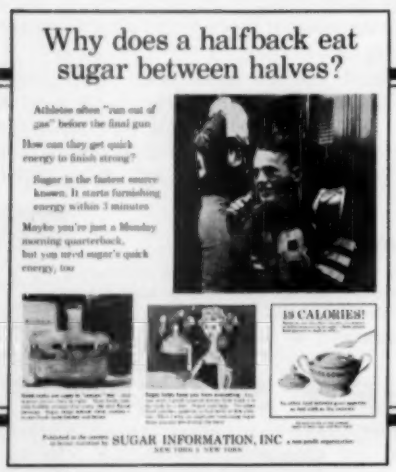
Athletes often "run out of gas" before the final gun

How can they get quick energy to finish strong?

Sugar starts furnishing energy within 3 minutes

No other food, by itself or in sugar packs, provides energy so fast


Why does a halfback eat sugar between halves?

Athletes often "run out of gas" before the final gun

How can they get quick energy to finish strong?

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Maybe you're just a Monday morning quarterback, but you need sugar's quick energy, too

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Mr. John Coleman	Prof. Lois Sather
Miss Elsie Dawson	Dr. Miles Sawyer
Dr. Helen Hanson	Miss Marion Simone
Dr. Amihud Kramer	Dr. Kenneth Weckel

Ad Hoc Committee on High School Career Day Activities

Preparation of a source paper which outlines the history and development of food technology, the type of education required at both the high school and college level for those preparing for careers in the field, types of jobs which food technologists hold, where the proper education may be acquired, etc.

Preparation of a series of slides of artists conceptions of landmarks in the development of food preservation and other points from the previously described paper.

Preparation of a leaflet describing Food Technology. This leaflet to be given to each student in attendance at High School Career Days throughout the United States.

Organization of a Task-Force who will assist those sections which have never previously held a Career Day to properly plan and execute one.

Establishment of a Bureau of Speakers for Career Days and high school and college Science Club meetings.

Membership:

Dr. Gale Ammerman, Chairman, Libby, McNeill & Libby, 13636 South Western Avenue, Blue Island, Illinois

Mr. Seb Davin	Mr. Jean Mauck
Dr. Mel Johnson	Mr. Dan Pratt
Mr. William Klinker	Dr. Oliver Worthington

Ad Hoc Committee on International Congress on Food Technology

This committee is to investigate and recommend action to be taken by the Institute on a proposed International Congress on Food Technology.

Dr. Emil Mrak, Chairman, University of California, Davis, California
Mr. M. L. Anson, 100 Eaton Square, London S. W. 1, England
Dr. John Nair, 9 Dunnder Drive, Summit, New Jersey
Dr. Guido Hilbert, Ag. Res. Service, U.S.D.A., Util. R & D, Washington 25, D. C.
Dr. George Stewart, University of California, Davis, California

Sub-Committee on Publications

Plans are being laid for the orderly replacement of our executive officers upon retirement.

The Editor has advised us that he would like to be relieved at the time of the 1961 annual meeting.

This committee is to study the following:

1. Type of person we should have as Editor.
2. Approximate time he should be on the job.
3. Compensation required for this type of person.
4. Possible candidates who could fill the bill.

Make recommendations to the ad hoc Committee on Administrative policy which will meet at the time of the Executive Committee meeting in December.

Dr. Howard Spencer, Chairman, Dow Chemical Company, Midland, Michigan

Dr. Reid Milner	Dr. Samuel Goldblith

Ad Hoc Committee on Regional Boundaries

1. Advise all Regional Sections of present established boundaries.
2. Secure official approval from Section officers of established boundaries.
3. Resolve any disputes between adjoining Regional Sections.
4. Make official recommendations to the mid-year meeting of Executive Committee so that they can take official action.

Miss Dorothy Ann Huber, Chairman, QM Food and Container Institute, 1819 West Pershing Road, Chicago 9, Illinois

Members are chairmen of the regional sections.

CHICAGO	AMES
Dr. George Beach	Dr. C. A. Iverson
NORTHERN CALIFORNIA	MOHAWK VALLEY
Mr. Bruno Filice	Mr. Henry Strecker
NORTHEAST	OHIO VALLEY
Dr. Ernest Barron	Mr. Radcliffe Robinson
SOUTHERN CALIFORNIA	OREGON
Mr. Henry Espoy	Mr. Alvin Randall
ST. LOUIS	DIXIE
Mr. Boris Miller	Mr. C. Cyril Lovvorn
NEW YORK	TEXAS
Dr. Roy Morse	Mr. Kenneth Kenease
FLORIDA	INDIANA
Mr. Joseph McAllister	Dr. Lee Truman
WESTERN NEW YORK	AK-SAR-BEN
Mr. Thomas Tolman	Dr. Robert Joslin
GREAT LAKES	WISCONSIN
Mr. F. J. Ericson	Dr. Kenneth Weckel
PHILADELPHIA	MINNESOTA
Mr. Richard Mullan	Dr. Jolyon Stein
MARYLAND	KANSAS CITY
Mr. Irving Cohen	Mr. Robert Maxwell
PUGET SOUND	WASHINGTON, D. C.
Mr. Maxwell Gibson, Jr.	Mr. William Hoover

PITTSBURGH
Mr. George Reymann

Ad Hoc Committee for the Study of Administrative Policy

This committee has the responsibility of formulating plans for the orderly replacement of the Executive Secretary and Editor upon retirement of the present incumbents.

This committee will meet at the time of the Executive Committee meeting in December and continue their planning to meet the required objectives.

Membership:

Dr. George Garnatz, Chairman, The Kroger Foundation, 1212 State Avenue, Cincinnati 4, Ohio
Dr. Imri Hutchings, H. J. Heinz Company, P. O. Box 57, Pittsburgh, Pa.
Dr. Aksel Olsen, 101 Crestwood Lane, Harbor Bluffs, Largo, Florida
Dr. Emil Mrak, University of California, Davis, California
Mr. Ray Wakefield, Gerber Products Company, 445 State Street, Fremont, Michigan

Ad Hoc Committee to Study Desirability of Making Grants from the Institute Treasury to Small Regional Sections

This committee is to determine first the desirability of this idea.

If it appears desirable, to make recommendations for a fair and equitable procedure for doing so.

Membership:

Dr. Imri Hutchings, Chairman, H. J. Heinz Company, P. O. Box 57, Pittsburgh, Pa.

Mr. Ray Junk	Dr. Harold Schultz
Mr. Robert Light	Dr. Marcus Wegner

Ad Hoc Committee to Study IFT Journals

1. Survey and study material and contents of our journals, FOOD RESEARCH and FOOD TECHNOLOGY.
2. Evaluate this material in terms of the basic objectives of the Institute.
3. Review the editorial policy relative to the contents of the journals.
4. Recommend policy that should be followed in the future as concerns the type of material that should be published in the journals.
5. Recommend the proper editorial control that should be established to assure that the proposed policy and objectives can adequately be met on a continuing basis.

6. Maintain close liaison with Publications committee so that no misunderstanding or duplication of effort results.
7. Make a report to the mid-year meeting of the Executive Committee.

Membership:

Dr. Imri Hutchings, Chairman, H. J. Heinz Company, P. O. Box 57, Pittsburgh, Pa.

Mr. M. L. Anson	Dr. George Stewart
Dr. Howard Spencer	Dr. Charles Stumbo
Dr. Harold Olcott	Dr. Oscar Williams

Ad Hoc Committee to Study and Recommend a Public Relations Program for the Institute of Food Technologists

1. Define what IFT needs in public relations.
2. Define ways best to achieve these goals.
3. Recommend a system for integrating this proposed program into the IFT structure.
4. At the proper time prepare a proposal of Rules and Procedures.
5. If possible, present a progress report at the December Executive Committee meeting.

Membership:

Mr. Loren B. Sjöström, Chairman, Arthur D. Little, Inc., 15 Acorn Park, Cambridge 40, Massachusetts

Mr. Elverton Stark	Mr. Norbert Leinen
Mr. Robert McMillen	Mr. John Ziemba

Mr. Charles McLaughlin

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Col. Charles Lawrence	Dr. Martin Peterson

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Ad Hoc Committee to Study Ways and Means of Advancing the Science of Food Technology

This committee to recommend to the Executive Committee at the December meeting possible areas of activity the Institute can best engage in to most effectively advance the science of Food Technology. This to include such areas as scholarships, awards, promotions, career days and any other areas the committee feels should be explored.

Membership:

Dr. Imri Hutchings, Chairman, H. J. Heinz Company, P. O. Box 57, Pittsburgh, Pa.

Dr. Robert Schaffner	Mr. Alan Richardson
Dr. Horace Sipple	Dr. Harold Schultz
Dr. Hans Lineweaver	Dr. Mathew Highlands

Liaison Representative to the Agricultural Research Institute of the National Research Council

Appointment by the president to keep the Institute informed of the activities of this organization. An annual report to the Council should be made.

Dr. Ira I. Somers, National Canners Association, 1133 20th St., N. W., Washington 6, D. C.

IFT Representatives to the Council of American Association for the Advancement of Science

These men serve as representatives of the Institute of Food Technologists on the coordinating committee of the American Association for the Advancement of Science and report to the Council transactions of interest to the Institute.

Dr. Charles N. Frey, 45 Cambridge Road, Scarsdale, New York

Dr. M. A. Joslyn, Department of Food Technology, University of California, Berkeley 4, California

Liaison Representative to the Food & Nutrition Board of the National Research Council

All appointments to the Food and Nutrition Board are made by the Chairman of the National Research Council. At the invitation of the National Research Council, the president of the IFT nominates a member for consideration and appointment as Liaison Representative. This appointment is for an indefinite period, but like all committee appointments is subject to annual reaffirmation by the president of the Institute. An annual report is made to the Council.

Dr. B. E. Proctor, Department of Food Technology, Massachusetts Institute of Technology, Cambridge, Massachusetts

Liaison Representative to the Food Protection Committee of the National Research Council

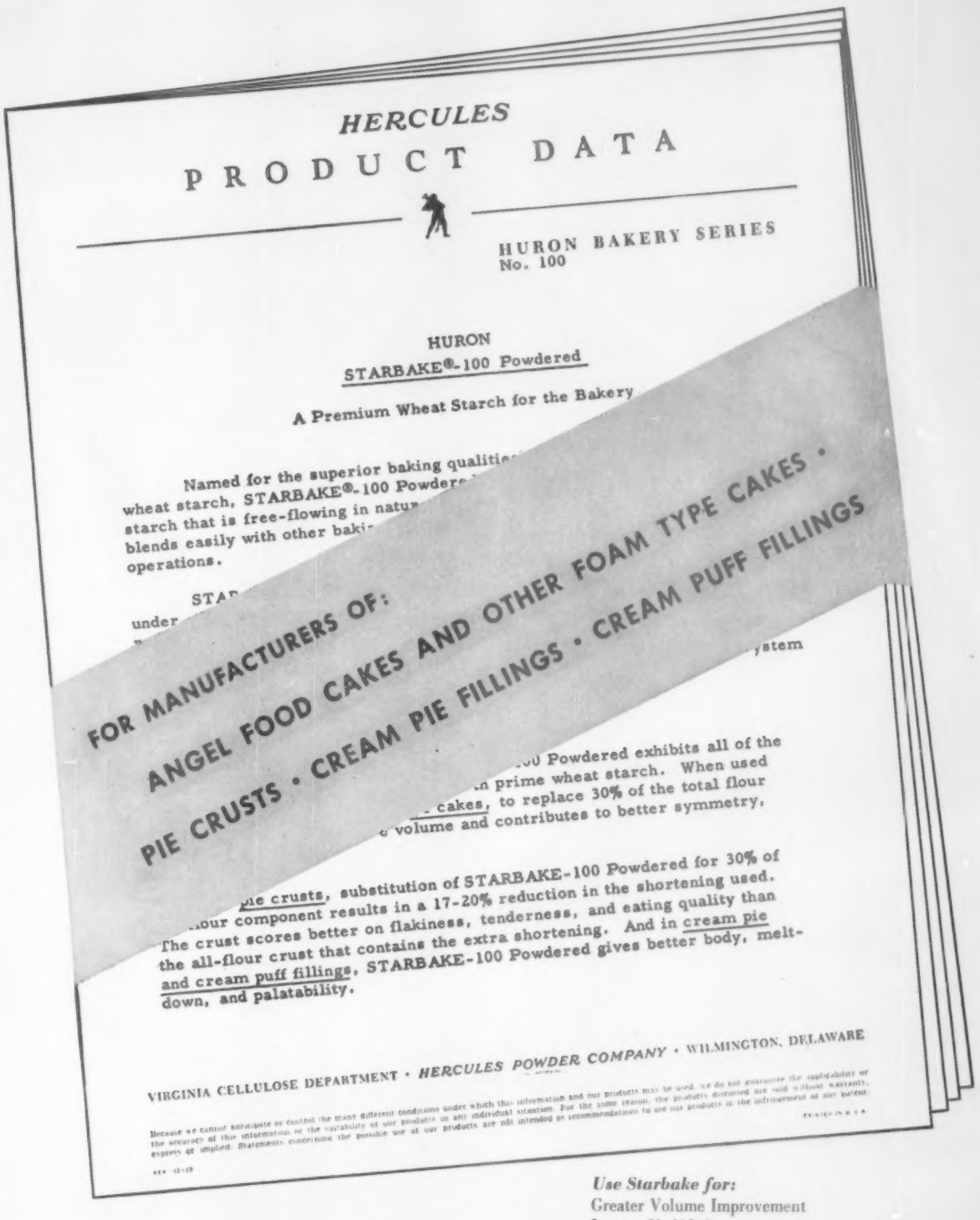
Appointed by the President to keep the Institute informed of the activities of this organization. An annual report will be made to the Council.

Dr. John F. Mahoney, Merck & Company, Inc., 1000 Woodmere Drive, Westfield, New Jersey

Liaison Representative to the U. S. National Committee for the International Institute of Refrigeration

This appointment to the Committee for the International Institute of Refrigeration is made by the National Research Council. At the invitation of the National Research Council, the president of the IFT nominates a member for consideration and appointment as Liaison Representative. This appointment is for a three year term starting July 1, 1959. An annual report is made to the Council.

Dr. H. C. Diehl, Trans-American Refrigerated Services, Ltd., P. O. Box 1275, 14 West Monument Street, Colorado Springs, Colorado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IFT NEWS

Special Attention to be Given Basic Research Papers at 1960 IFT Meeting in San Francisco

BASIC RESEARCH will be emphasized at the 20th Annual Meeting of IFT at San Francisco, May 15–19, 1960. Basic research in this instance refers to research on food components that are especially important in establishing the performance or stability characteristics of foods. Such research is more nearly component oriented than commodity oriented. Emphasis is given to the chemistry of these components as related to food properties rather than to "pure chemistry" of the components. Thus, we are concerned with hydrolysis, oxidation, protein coagulation, emulsification, gelation, browning reactions, viscosity, texture, etc., of these components especially with respect to changes that may occur during processing, storage, separation and use for food remanufacture or formulation. Yet, it is not the intention to cover specific products or formulations.

The following four types of food components have been selected each for a half day session:

Food Lipids—Dr. Betty M. Watts, Chairman

Food Proteins—Dr. R. E. Feeney, Chairman

Food Carbohydrates (starch, pectin, sugar, cellulose)—Dr. Z. I. Kertesz, Chairman

Food Enzymes (deteriorative, useful)—Dr. L. A. Underkofler, Chairman.

Your program committee intends no slight of other important components such as vitamins, flavor components and pigments. Your committee has made a selection, because one had to be made.

An invited introductory talk dealing with the principles of lipid chemistry, protein chemistry and so on is to be given in each of these sessions. Contributed papers to follow are to report advances in the respective fields. Contributions (titles and abstracts) should be sent to the general program chairman according to the schedule appearing in the September issue of FOOD TECHNOLOGY. However, the author should indicate that he desires to present it in the appropriate basic session.

Basic research progresses toward generalizations, reduces the need for trial and error research and satisfies that innate desire to know *why*, so that we can know *how* to do a better job. What generalizations can be made on the basis of present knowledge? Are the present limitations of generalizations so great as to seriously hamper the usefulness of generalizations? Is progress in basic food research fast enough? Where should it be done? How can additional basic research be sponsored, if more is needed? It is felt that more specific thought should be given to questions such as these and that the specifically designated basic research sessions will serve to illustrate our present position and future potential with respect to knowledge of "what makes a watch tick besides the winding of it," so to speak.

These sessions may have some of the elements of a symposium or discussion panel, but the foremost theme is *new* contributions to basic food knowledge.

HANS LINEWEAVER
Vice Chairman
1960 Program Committee

FUTURE MEETINGS FOR FOOD TECHNOLOGISTS

October 12-14	Association of Official Agricultural Chemists, Shoreham Hotel, Washington, D. C.
October 23	12th Annual Conference, Southern California Section, IFT, and Nutrition Foundation, Inc. Miramar Hotel, Santa Monica, California. Theme: Current Trends in Food and Nutrition
November 4-6	Sectional Meeting of the Society for Applied Spectroscopy and Instrument Exhibition, Hotel New Yorker
November 16-18	Annual National Packaging Forum of the Packaging Institute, Inc., Hotel Statler, New York, N. Y.
November 16-19	International Soft Drink Industry Exposition, Kiel Auditorium, St. Louis, Missouri
1959-1960	
December 26-January 3	Dairy and Food Exposition, New York Coliseum, New York, N. Y.
February 11-13	National Food Conference, Palmer House, Chicago, Illinois
1960	
May 15-19	**Twentieth Annual Meeting of the Institute of Food Technologists, Fairmont Hotel and Masonic Temple, San Francisco, California**
May 19 to May 25 or 29	**IFT Pacific Rim Conference, Princess Kaiulani Hotel, Honolulu, Hawaii**
1961	
May 7-11	**Twenty-first Annual Meeting of the Institute of Food Technologists, Hotel Statler, New York, New York**
1962	
June 17-20	**Twenty-second Annual Meeting of the Institute of Food Technologists, Americana Hotel, Bal Harbor, Miami Beach, Florida**

An open invitation is extended to readers of FOOD TECHNOLOGY to send in to the Editorial Office, 11606 South Bell Avenue, Chicago 43, Illinois notices of annual or national meetings of interest to food technologists.

REGIONAL NEWS

AUSTRALIA N.

Qantas Factory Visit. Thirty members availed themselves of the opportunity of doing the Qantas tour of inspection on Thursday afternoon, June 4th. Incidentally, as the number had to be restricted to thirty, many members who were late in phoning acceptance could not be accommodated. The party assembled at the Passenger Services Building, King St., Mascot, at 12:30 p.m. and there we were met by Ron Edwards and escorted direct to a mock fuselage, and were treated as passengers on an overseas flight. The menu read something like this: Cocktails, etc., and canapes of extensive quantity and quality, Kangaro tail soup, lobster, roast duck with orange sauce, followed by a continental ice-cream and the usual coffee, cheese, etc. The second stage of the tour found most of us waddling like ducks over to the kitchens and freezing section, where we were able to see canapes and the basic ingredients of several types of menu being prepared by the Chef and his staff, and then into the freezer.

Finally, an extremely interested party toured the Flight training centre, where all Qantas flight personnel do routine check flights as well as training and conversion courses to more involved aircraft. We were able to inspect a Superconstellation training cabin, and a Boeing 707.

The thanks of the Institute and in particular those fortunate enough to attend, go to Qantas and its staff for a wonderful afternoon. It was generally agreed that, if what we received for lunch was a representative sample of a meal served on an overseas flight, then Qantas won 30 potential passengers.

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OREGON

During the past year, the Oregon Section held six regular meetings. They were as follows:

October 3, 1958. A joint meeting was held at Lewis and Clark College in Portland with the Portland Section of the American Society for Quality Control.

November 14, 1958. A tour of the American Can Company Facilities in Portland was held and members of the company gave brief remarks concerning their respective fields of interest. In addition president elect Ray Wakefield of the National Institute of Food Technologists presented an excellent discussion on "Why Industry Needs Well Trained Food Technologists."

January 20, 1959. A breakfast meeting was held jointly with the Puget Sound Section at the annual meeting of the Northwest Canners and Freezers Association in Portland. At this meeting, Dr. Ira Sommers spoke on recent advances in canning technology.

February 4, 1959. A dinner meeting was held in Corvallis, Oregon in connection with the Annual Food Processors Short Course at Oregon State College. At this meeting was Mr. Charles Burst, a local candy manufacturer, who spoke on some of his experiences in making and selling hand made candies in a small community.

March 14, 1959. The second Annual High School Career day was held at Corvallis under the chairmanship of Jack Yolland of the Continental Can Company. The theme of the program was "A Day at OSC" and 68 students and 16 teachers attended from high schools throughout Oregon. This meeting was reported in the June 1959 issue of FOOD TECHNOLOGY.

April 24, 1959. The Annual Meeting was held in Salem at which time the officers for the coming year were elected. Speakers at the meeting were E. Terry Dalton, speaking on SQC and food processing and O. J. Worthington speaking on basic concepts of SQC and Ken Carl speaking on quality control of dairy products.

These are the high lights of the year for the Oregon Section Institute of Food Technologists. Planning is now under way to make the coming year's program equally as fruitful.

—Roy E. Moser

S. CALIFORNIA

Current Trends in Food and Nutrition to be theme of 12th annual conference sponsored jointly by the

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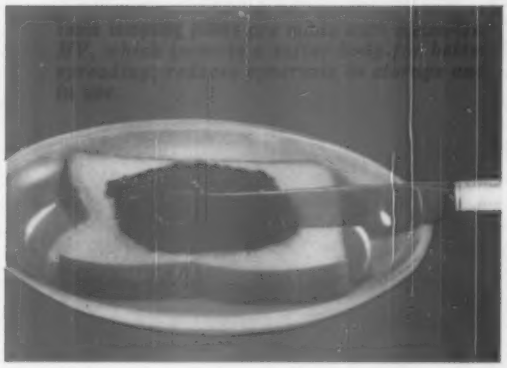

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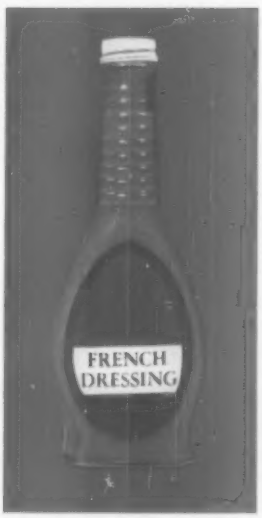

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Southern California Section of the Institute of Food Technologists and The Nutrition Foundation, Incorporated.

The all day meeting will be held at the Miramar Hotel in Santa Monica, California, on October 23, 1959, starting at 9:30 a.m. All members of the Food and Allied Industries are invited to attend.

Dr. Charles Glen King, executive director of the Nutrition Foundation and noted authority on nutrition will be the luncheon speaker. His topic is, "Values Derived From Coordination and Initiative in Nutrition Research."

Complete Conference Program

1. "Carbohydrate Metabolism and Related Problems in Human Nutrition," by Dr. A. E. Renold, Department of Medicine, Harvard University Medical School.
2. "Fat Metabolism and Related Problems in Human Nutrition," by Dr. F. J. Stare, Department of Nutrition, Harvard School of Public Health.
3. "Micro-mineral Balances in Nutrition," by Dr. George Davis, Department of Animal Husbandry and Human Nutrition.
4. "Protein and Amino Acid Balances in Human Nutrition," by Dr. W. H. Sebrell, Jr., Institute of Nutrition Sciences, Columbia University.
5. "Enhancement of Protein Value for Human Nutrition With Special Reference to Lysine Supplements," by Dr. C. L. Wrenshall, Chas. Pfizer and Company, Inc.
6. "Dietary Factors Affecting Utilization of Food Ingredients," by Dr. Tom Jukes, Nutrilite Products Inc.
7. "Who Cares About Nutrition?," by Dr. Shoi Dickenson, Ward Jensen Associates.

Literature

BOOKS

POTATO PROCESSING. William F. Talbut and Ora Smith. The Avi Publishing Company, Inc., Westport, Connecticut, 1959, 475 pages.

This is a well organized work which should prove to be of interest and significant value to those concerned with any of the various segments of the potato processing industry. The twenty chapters give ample coverage to all areas of the industry, from growing of the raw product to the finished item as delivered to the consumer. Included are thorough discussions on structure and chemical composition, varieties, effect of growing conditions, diseases, sprout inhibition, transit and handling conditions, nutritive properties, and preparation of the raw product for processing. Material presented in each of these chapters is related directly to end-product qualities. Detailed descriptions of processes for the various types of frozen, dehydrated, and canned products are also presented. The bibliographies in each of the chapters provide those seeking more detailed information in their particular field of interest with ample references. The appendix describes methods for determination of total solids and reducing sugars in raw potatoes.

The authors, themselves well recognized authorities in the field, make available for the first time, the knowledge of experienced specialists in all phases of the potato processing industry—chips, frozen French fries, flakes, flour, livestock feed, etc. The material is presented in concise and readable form, and records the current status, particularly with reference to new processes and products.

Arrangement of the technical material in this book makes it readily adaptable to use as a text in college courses. Talburt and Smith's book should stimulate wide interest among technologists in the versatility of the potato as a food product and the exploitation of this characteristic by food scientists and technologists the world over.

ALBERT C. RAUCH
Hinsdale, Illinois

LITERATURE ON FOOD RESEARCH AND TECHNOLOGY[a]

Commodities

Plants approved to pack processed fruits and vegetables under continuous inspection. Washington, U.S.D.A. Agricultural Marketing Service, 1959. 28 p. processed.

Some tropical South Pacific island foods. Mary Murai, Florence Pen, and Carey D. Miller. Honolulu, Hawaii, University of Hawaii Press, 1958. 159 p. pap. $2.00. The sub-title "Description, history, use, composition, and nutritive value," tells the story.

Food Technology

American Meat Institute Foundation. Annual report, 1957–1958. Chicago 37, The Foundation, 939 E. 57th St., 1959. 57 p. (Its Bulletin 42.) Short summaries of the projects being carried on.

Proceedings, AMIF industry research report meeting, 1959. Chicago 37, American Meat Foundation Institute, 939 E. 57th St., 1959. 54 p. (Its Circular no. 51.) Summaries of 18 reports made at the meeting.

[a] Material for this list should be sent to Dr. James G. Hodgson, Chief, Library Branch, Quartermaster Food and Container Institute for the Armed Forces, 1819 West Pershing Road, Chicago 9, Illinois.

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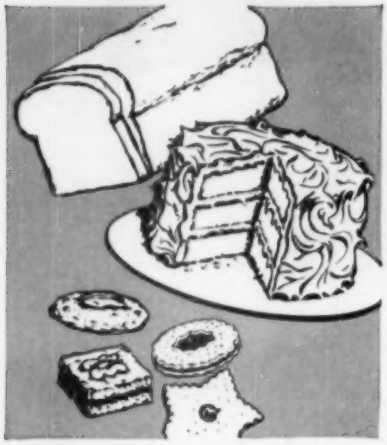

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Laboratory manual for food microbiology. W. C. Frazier and E. M. Foster. Burgess Pbl. Co., Minneapolis.

Containers

Resistance of drums and barrels containing nonfat dry milk to insect invasion. F. O. Marzke. Washington, D. C., 1959. 9 p. (U.S.D.A. Marketing research report, 307.) pap. apply.

Reusable, dehumidified cargo containers (A study to determine optimum container size.) Washington, Department of Commerce, Office of Technical Services, 1919. 94 p. pap. PB 151641, $2.50. An issue for sale of a report prepared by the U. S. Department of the Army. Transportation Corps as Third interim report, Project 9-91-03-000, Task 302T, December 1958.

Biological Aspects

Behavior of enzyme systems. John M. Reiner. Minneapolis, Burgess Pub. Co., 1959. 329 p. $6.50. A mathematical analysis of enzyme activity for research workers. Author is at Emory University.

Dairy microbiology. Edwin M. Foster and others. Englewood Cliffs, N. J., Prentice Hall, 1959. 500 p. $11.65. Authors are from a number of leading land-grant schools.

Nutrition Research Laboratories, Coonoor. *Annual report* for 1957–58. Coonoor, South India, 1958. 60 p. pap. Summaries of results on projects undertaken. Laboratory is under the Indian Council of Medical Research.

Physico-chemical properties of wheat proteins. Soc. Chem. Ind. Monograph No. 6. London, 1959. 92 p. $2.00. Order from Macmillan, N. Y.

Chemical Aspects

Annual review of biochemistry, v. 28. James M. Luck and others, eds. Palo Alto, Cal., Annual Reviews, 1959. 705 p. $7.00. A continuation of one of the earliest of the "annual review" series.

Antibiotics, their chemistry and nonmedical uses. Herbert S. Goldberg, ed. Princeton, N. J., D. Van Nostrand, 1959. 618 p. $15.00. Covers in addition to the chemistry, its use in nutrition and food preservation.

Biochemical and biophysical research communications, v. 1, no. 1. July 1959. New York, Academic Pres, 1959 + Six issues a year. $12.00. A new journal for short well documented communications, as a companion to Archives of biochemistry and biophysics.

Fatty acids in food fats. V. R. Goddard and L. Goodall. Washington, 1959. 4 p. (U.S.D.A. Home economics research report 7.) pap. apply.

Economic Factors

Buying practices and food use of employee food services in manufacturing plants. Rosalind C. Lifquist. Washington, U. S. Govt. Print. Off., 1959. 135 p. (U.S.D.A. Marketing research report, no. 326.) pap. $0.75.

Factors affecting costs of wholesale distribution of frozen foods. H. Wayne Bitting. Washington, U. S. Govt. Print. Off., 1959. 56 p. (U.S.D.A. Marketing research report, no. 327.) pap. $0.30.

Geography of food supply in Central Minas Gerais. Kempton E. Webb. Washington, National Research Council, 1959. 119 p. (Foreign Field Research Program. Report no. 4; publ. 642.) pap. $2.00.

Acceptance

Nutritive value and consumer acceptance of frozen poultry. Ines Prudent. Wooster, Ohio, 1959. 40 p. (Ohio. Agricultural Experiment Station. Research bulletin 835.) pap. apply.

Miscellaneous

1958–59 workers in subjects pertaining to agriculture in land-grant colleges and experiment stations. Washington, 1959. 224 p. (U.S.D.A. Agricultural handbook 116.) Includes workers in nutrition and food technology in most cases.

Publications and patents, July—December 1958. U.S.D.A. Southern Utilization Research and Development Division. New Orleans, 19, La., The Division, Post Office Box 7307, 1959. 22 p. pap. apply.

Punched cards. R. S. Casey, J. W. Perry, M. M. Berry, and A. Kent, eds. New York, Reinhold Pbl. Corp. 697 p. Bibliography and index. $15.00.

Toxicology and Applied Pharmacology. Vol. 1, No. 1, January 1959. Academic Press, Publishers, New York and London. A new journal edited by Frederick Coulston, and Arnold J. Lehman.

ABSTRACTS

General Foods Research Center
Selected by H. A. Campbell

ANALYTICAL METHODS

Gas chromatographic analyses of products from aldol condensations.

WARREN, G. W., LAMBDIN, W. K., et al. (Union Carbide Chem. Co., South Charleston, W. Va.). *Anal. Chem. 31,* 1016–19 (1959).

The dimerization of aldehydes or cross-condensation of 2 different aldehydes in

the presence of alkali usually results in mixt. of by-products. For optimum reaction conditions in lab. processes, reliable methods of analysis of various mixts. are required. This method is more rapid and precise than a mass spectrometric method. The paper describes the results obtained with 3 condensation mixts.: acetaldehyde with butyraldehyde, isobutyraldehyde, with propionaldehyde. The major components in these mixts. can be analyzed with ± 4% precision.

Separation of hydrogen isotopes by gas-solid chromatography.

GANT, P. L. AND YANG, K. (Continental Oil Co., Ponca City, Oklahoma). *Science 129*, 1548-9 (1959).

Conditions are described for the chromatographic analysis of mixts. of H_2, HT, and T_2 on a "molecular sieve" column. This technique may find valuable applications in various kinetic investigations.

BIOLOGICAL SCIENCES

Biochemistry

Electrophoretic method for desalting amino acids.

NICHOL, J. C. (Oak Ridge Natl. Lab., Tenn.). *Science 129*, 1549–50 (1959).

A soln. to be desalted is placed on a paper strip along which an ammonium formate buffer gradient has been established. Application of a potential brings about migration of amino acids to their isoelectric pH's and removal of salt ions. The strip is eluted with water, and the eluate is freed of ammonium formate by vacuum sublimation at 40° C.

A shorthand version of the Mitchell method for determination of the biological value of protein. Growth rate as a source of error.

NJAA, L. R. (Norwegian Fisheries Research Inst., Bergen). *Brit. J. Nutrition 14*, 137–42 (1959).

The biol. value of herring-meal protein was detd. in expts. with young rats. A shortened version of the Mitchell method for detn. of the biol. value of protein was worked out. The shortened version was compared with the original in expts. with 2 herring meals. The two versions gave substantially the same results.

Current views on the process of urea formation in animals.

BEREZOV, T. T. *Clin. Chem. 5*, 218–38 (1959).

The literature concerning the mechanisms of enzymatic urea synthesis of interest to biochemists, clinicians and pathologists is reviewed. The data presented confirm that urea-N from amino acids and other N compds. must either be utilized as ammonia or be transformed in

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some way to NH_2 group N in L-aspartic acid. It is also postulated that ammonia is the direct source of one urea N atom, introduced via the synthesis of citrulline from ornithine in the urea cycle, while the other atom is derived from L-aspartic acid via the tranformation of citrulline into arginine.

Oxidative cleavage of amides. A method for selective chemical degradation of peptides.

COREY, E. J. AND HAEFELE, L. F. (Univ. of Illinois, Urbana). *J. Am. Chem. Soc. 81*, 2225–8 (1959).

It has been demonstrated that the carbonyl-nitrogen fission of tyrosine amides by bromine, first observed by du Vigneaud and co-workers with oxytocin and vasopressin, occurs with simple tyrosine amide and phloretamide derivs. as well. The cleavage reaction has been shown to be an oxidative process in which the phenolic ring is converted to a dienone system, and not simple hydrolysis. The studies indicate that the reaction is general for this type of amide and is useful for the selective chemical degradation of peptides.

Microbiology

Death of bacteria in growing culture.

KOCH, A. L. (Argonne Natl. Lab., Lemont, Ill.). *J. Bacteriol. 77*, 623–9 (1959).

In growing cultures of *Escherichia coli* maintained under constant conditions, cell death followed by lysis is a rare phenomenon. If, however, the cells are chilled and centrifuged, approximately 5%/hr. of a variety of labelled cellular components are released into the growth medium in an ultrafiltrable form. This release of labeled materials is interpreted as the autolysis of cells killed by the chilling and centrifugation procedures employed.

Detection of typhoid carriers by agglutination tests.

SCHUBERT, J. H., EDWARDS, P. R. AND RAMSEY, C. H. (U. S. Dept. of Health, Educ., and Welfare, Atlanta, Ga.). *J. Bacteriol. 77*, 648–54 (1959).

Tests for O and H agglutinins were of no value in the detection of carriers. Of the Vi agglutination tests, hemagglutination was found to be most useful since it gave no reaction with sera of control groups and was positive with 91.6% of sera from typhoid carriers. It is emphasized that no serological test nor combination of tests yet devised can be relied upon to detect all carriers of *S. typhi*.

Search for substances which reduce the heat resistance of bacterial spores.

MICHENER, H. D., THOMPSON, P. A. AND LEWIS, J. C. (Western Regional Research Lab., Albany, Calif.). *Appl. Microbiol. 7*, 166–73 (1959).

About 650 substances were tested for ability to reduce the heat resistance of spores of the *Clostridium* sp. strain PA 3679 suspended in thermal death time tubes of Andersen's pea-pork medium and heated at 113° C. The tubes were heated sufficiently to kill 75 to 95% of the spores in controls having no test substance, after which they were diluted and plated. At total diln. of 1:1000, the small amt. of test substance carried into the plate usually had no inhibitory effect. The effect of each test substance on the D value of the spores (the heating time required to reduce survival by 90%) was calcd. from the plate counts of the survivors.

Nutrition

Filtration versus local formation of lipids in pathogenesis of atherosclerosis.

HOLMAN, R. L., MCGILL, H. C. AND STRONG, J. P. (Louisiana State Univ., New Orleans). *J. Am. Med. Assoc. 170*, 416–20 (1959).

The best available evidence makes it seem likely that the active principles that govern lipid transportation and local accumulation are enzyme-hormone complexes and indicates that active metabolic work is performed by the mesenchymal cells in the inner layers of the arterial wall. Much confusion can be avoided by keeping interspecies differences in mind and recognizing the probable stage of atherosclerosis in man at any given age. The three stages leading to clinical disease are fatty streaking in the first two decades, conversion of some fatty streaks to fibrous plaques in the second two decades, and local complications such as hemorrhage and thrombosis about a plaque in the third two decades.

Studies on blood lipids during exercise. I. Arterial and venous plasma concentrations of unesterified fatty acids.

CARLSON, L. A. AND PERNOW, B. (King Gustaf V Research Inst., Stockholm, Sweden). *J. Lab. Clin. Med. 53*, 833–41 (1959).

The plasma concn. of unesterified fatty acids in the arterial blood decreased during exercise. The findings have been discussed in relation to the energy metabolism of exercising muscular tissues.

Influence of D-sorbitol on plasma concentrations of vitamin B_{12}.

BOGER, W. P. AND PARMELEE, E. T. (Norristown State Hosp., Penna.). *Metabolism: Clin. and Exptl. 8*, 126–35 (1959).

The mechanism by which D-sorbitol, orally administered in conjunction with B_{12}, increases plasma concns. of the vitamin is not clear. It is suggested that patients, whose bodily reserves of vitamin B_{12} were below normal were repleted by the formation of a complex between B_{12} and D-sorbitol that facilitates gastrointestinal absorption.

Effects of croton oil on sugar absorption by isolated surviving guinea pig intestine.

DURUISSEAU, J. P. AND QUASTEL, J. H. (McGill-Montreal General Hosp., Can.). *Proc. Soc. Exptl. Biol. Med. 100*, 711–14 (1959).

Croton oil (0.5%), when present in an oxygenated Ringer medium circulating through lumen of isolated surviving guinea pig intestine, inhibits active glucose absorption. It has relatively little effect, under identical exptl. conditions, on active galactose absorption. Cod liver oil and olive oil, under same exptl. conditions, have little or no effect on glucose absorption by the isolated intestine. Presence of L-phenylalanine in the mucosal soln. diminishes inhibition of active glucose absorption by croton oil.

Fasting as an introduction to the treatment of obesity.

BLOOM, W. L. (Piedmont Hosp., Atlanta, Ga.). *Metabolism: Clin. and Exptl. 8*, 214–20 (1959).

Prolonged total fasting (4 to 9 days) with free access to water was well tolerated by 9 obese patients who were hospitalized but ambulatory. The patients experienced comparatively few undesirable symptoms; indeed, during the fast, many reported a marked sense of well being, suggesting a mild euphoria. Weight loss averaged 2.6 lb./day of fasting in 4 males and 2.7 lb./day in 5 females. Follow-up studies indicate that all patients have maintained a large part of the wt. loss achieved during the fast and, in most instances, have continued to lose wt. by dieting.

A study on the digestion of cellulose in poultry.

TASAKI, I. AND KIBE, K. (Nagoya Univ., Japan). *Poultry Sci. 38*, 376–9 (1959).

α-Cellulose fed to birds was found to be degraded partially to cellulose in the digestive tract of birds, but the cellulose thus produced was not absorbed by the birds but was excreted. γ-Cellulose was excreted in the same amts. as given in the diet.

Growth response to dietary penicillin of germ-free chicks and of chick with a defined intestinal flora.

LEV, M. AND FORBES, M. (Walter Reed Army Inst. of Research, Washington, D. C.). *Brit. J. Nutrition 13*, 78–84 (1959).

Germ-free chicks were reared in Reyniers germ-free units and their response to dietary penicillin was compared with that of similar chicks whose gut had been intentionally populated with certain bacteria. Procaine penicillin G added to the diet (45 mg./kg.) had no effect on the growth of germ-free chicks or of chicks

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with a flora composed of bacteria that itself did not affect growth, but did counteract the growth depression due to the presence in chicks of *Cl. welchii*. *Cl. welchii* may therefore be a factor in the growth-depressing 'infection' that is counteracted by penicillin supplements in the diet.

Effect of pantothenic acid on the longevity of mice.

PELTON, R. B. AND WILLIAMS, R. J. (Univ. of Texas, Austin). *Proc. Soc. Exptl. Biol. Med. 100*, 632–3 (1959).

The mean life span for the mice given supplementary calcium pantothenate was 653.1 days and that for the control mice was 549.8 days. The mice which received the vitamin supplement maintained slightly greater body weight after they were approximately 250 days old.

Toxicology

The toxicology of tin compounds.

BARNES, J. M. AND STONER, H. B. *Pharm. Revs. 11*, 211–31 (1959).

The authors have compiled a critical review of the biological activities of tin compds. in the human body. After noting briefly the uses of tin compds. in the biological field, the properties of the inorg. and org. compds., particularly alkyl tin derivs., are reviewed. When present in food, even up to the permitted level, inorg. tin compds. appear to have no potential health hazards. 105 references.

Effect of niacinamide on cardiac output, cardiac excitability and membrane action potential of single cardiac muscle fibers.

HUANG, T. (Downstate Med. Center, Brooklyn, N. Y.). *Am. J. Physiol. 196*, 735–7 (1959).

The actions of niacinamide on cardiac output and cardiac excitability of the dog heart and on the action potentials of individual frog ventricle cells were recorded. This drug increases respiratory and circulatory action chiefly through a stimulatory action on the heart.

ENGINEERING RESEARCH

Upping column extraction efficiency by pulse application—sieve columns.

GOLDBERGER, W. M. AND BENENATI, R. F. (Polytechnic Inst. of Brooklyn, N. Y.). *Ind. Eng. Chem. 5*, 641–4 (1959).

Mechanical agitating of extractor column liquids speeds up the sepn. process. Pulse extn. can be used with existing as well as new equipment.

FOOD AND FOOD TECHNOLOGY

Fats and Oils

Report on antioxidants in oils, fats, and waxes.

CONROY, H. W. (Food and Drug Administration, Kansas City, Mo.). *J. Assoc. Offic. Agr. Chemists 42*, 358–62 (1959).

Methods for the detn. and identification of propyl gallate, butylated hydroxyanisole, butylated hydroxytoluene, and nordihydroguaiaretic acid in edible fats are described, and the results of a collaborative study are described.

Feedstuffs

Note on the use of detergents for removal of nitrogen from plant materials.

BEVENUE, A. AND WILLIAMS, K. T. (Western Regional Research Lab., Albany, Calif.). *J. Assoc. Offic. Agr. Chemists 42*, 441–4 (1959).

One per cent aq. solns. of 2 detergents (Santomerse No. 1, and alkyl aryl sulfonate, and Duponol C, a sodium dodecyl sulfate) contg. 0.5% Na_2CO_3 removed 92–95% of the nitrogen from lima bean, navy bean, and split pea meals. Duponol C was tested with lima beans and it was observed that only a trace of the hemicellulose component of the bean was removed. The non-ionic detergents tested were not efficient in removing nitrogen from lima bean, navy bean, and split pea.

Flash desolventizer operation to produce soybean protein flakes.

BREKKE, O. L., MUSTAKAS, G. C., et al. (Northern Regional Research Lab., Peoria, Ill.). *J. Am. Oil Chemists' Soc. 36*, 256–60 (1959).

The flash desolventizing process removes hexane to produce high-quality, essentially undenatured, soybean protein flakes for industrial uses. The most practical level of solvent removal is achieved when solids are heated to 170°–190° F. and dried to a moisture and volatiles content of 7–8%. The desolventized solids should then contain less than 0.5% residual hexane. The installed cost of a flash desolventizer should be less than the cost of systems presently used to produce soybean protein flakes and operating costs should be in the same range, but the solvent loss may be a little higher.

Fish

Fish macaroni.

BHATIA, D. S., MOORJANI, M. N., et al. (Central Food Technol. Research Inst., Mysore). *Food Science* (India) *8*, 7–9 (1959).

The practical possibilities of utilizing fish flesh by blending it with tapioca flour to process it in the form of macaroni with a good shelf life have been indicated. The finished product is cheap and can be adapted on a cottage-scale with minimum of equipment. Conditions have been worked out to confer hardness to the finished product by following varied processing steps.

Gelatin

Graphic measurements of unmolded gels.

PINTAURO, N. D. AND LANG, R. E. (General Foods Corp., Tarrytown, N. Y.). *Food Research 24*, 310–18 (1959).

Several alternative methods for the objective measurement of sag and change of shape of unmolded gels were investigated. A special test cabinet was designed, consisting of a series of compartments, sample platform and a light source to cast the shadow of the gel on a photographic plate. The design includes provisions for casting a succession of shadows on the same photographic plate without disturbing the sample or opening the compartment. Measurements can be made over a range of temps. and relative humidities.

Occurrence of 'ester-like' linkages in collagen.

GALLOP, P. M., SEIFTER, S. AND MEILMAN, E. (Long Island Jewish Hosp., New Hyde Park, N. Y.). *Nature 183*, 1659–61 (1959).

In order to investigate the possibility that primary linkages other than peptide or iminopeptide bonds contribute to the stability of the collagen structure, the effect of hydroxylamine on 3 types of gelatin was studied. The gelatins were cleaved by either hydroxylamine or hydrazine under conditions favoring the disruption of ester bonds, without the concomitant splitting of peptide bonds. The results strongly suggest that ester-like bonds exist in parent gelatin, and that the specific disruption of these bonds releases fundamental sub-units of the protein molecule.

Calcification of collagen.

SANTANAM, M. S. (Univ. of Madras, India). *J. Mol. Biol. 1*, 65–8 (1959).

The paper deals with a study of the deposition of calcium phosphate in the form of apatite crystallites inside collagen fibers. By treating collagen fibers with a suspension of pptd. calcium phosphate, an excellent pptn. of hydroxyapatite inside the collagen was obtained. The X-ray diffraction pattern of the treated specimen showed a striking similarity to that of a section of normal bone. Increased addn. of citric acid inhibited the deposition of apatite while a still larger concn. of citric acid resulted in the crystn. of calcium citrate itself. The presence of other salts like calcium carbonate and calcium chloride suppressed the deposition of apatite.

Milk and Milk Products

Studies on milk powders. III. The preparation and properties of milk powders containing low melting butter oil.

BAKER, B. E., BERTOK, E. AND SAMUELS, E. R. (Macdonald Coll., Quebec, Can.). *J. Dairy Sci. 42*, 1038–44 (1959).

Butter oil was fractionated to obtain products melting at 19–21, 22–24, and 28–30° C. Agglomerated milk powders were prepd. each contg. one of these fat fractions, and one powder was prepd. contg. the unfractionated butter oil. The results suggest that control of the physical properties of the fat component of a dried milk powder provides a means of preparing a milk powder with the fat content of whole milk powder and the wettability and dispersibility of a superior grade of instant skimmilk powder.

Insecticide residues in milk and milk products. II. Insecticide residue in milk from dairy cattle fed treated crops.

MARTH, E. H. AND ELLICKSON, B. E. (Natl. Dairy Products Corp., Glenview, Ill.). *J. Milk Food Technol. 22*, 145–9 (1959).

When feeds treated with chlorinated hydrocarbon insecticides were fed to dairy cattle, residues of benzene hexachloride, chlordane, DDT, dieldrin, endrin and toxaphene appeared in the milk. Aldrin, heptachlor and methoxychlor were not detected in significant amts. Residues of org. phosphate insecticides also occur on feeds and hence are ingested by dairy cattle, however, they generally do not appear in milk. It is believed that the insecticides are broken down in the rumen.

Nuts

A new edible, nutritive, protective glaze for confections and nuts.

COSLER, H. B. *Mfg. Confectioner 39*, 21–3 (May 1959).

This confectioners glaze combines zein and an acetylated glyceride and has proved to be superior in performance to shellac. The zein provides the oil barrier and the glyceride the moisture barrier. It can be applied both to confections and nuts.

Taste Testing

Taste sensitivity in aging persons.

BYRD, E. AND GERTMAN, S. (Univ. of Miami, Florida). *Geriatrics 14*, 381–4 (1959).

Taste sensitivity was examd. in 3 age groups. Except for a few cases of severe taste impairment, older persons do not differ significantly from younger ones. Anatomic changes do not appear to account for many food and taste complaints common in older persons.

Interaction of sucrose and calcium cyclamate on perceived intensity of sweetness.

KAMEN, J. (Quartermaster Food and Container Inst., Chicago, Ill.). *Food Research 24*, 279–82 (1959).

Pure solns. of 2 sweetening agents, calcium cyclamate and sucrose, and mixts. of these solns. were rated by judges for intensity of sweetness. At the highest and lowest soln. concns., the perceived intensities of the mixts. did not depart markedly from the perceived intensities of the average of the pure solns. comprising the mixts. At moderate soln. concns., however, the perceived intensities of the mixts. were significantly higher than the intensities of the pure solns.

Miscellaneous

A critical appraisal of photomicrographic illustration.

MCCOMB, S. J. (Mayo Clinic, Rochester, Minn.). *J. Biol. Photographic Assoc. 26*, 145–54 (1959).

The prepn. of a satisfactory illustration begins with thought to its need, its use, and the manner in which it will supplement the text. Attention has been directed to some causative factors in poor illustrative quality in photomicrography, and possible methods of improvement are offered.

PACKAGING

The mechanism of corrosion of tin plate by various food products.

FRANKENTHAL, R. P., CARTER, P. R. AND LAUBSCHER, A. N. (United States Steel Corp., Monroeville, Pa.). *J. Agr. Food Chem. 7*, 441–2 (1959).

The corrosion mechanism of tin plate under conditions duplicating normal canned-food packs was studied. In grapefruit and tomato juice, the dissolution of the tin coating is accompanied by the evolution of hydrogen; in prunes, hydrogen does not appear to be evolved when the tin dissolves, but only when the steel base is attacked. In prunes, all tin plates detin at the same rate, but in grapefruit and tomato juice the rate of detinning is not the same for different types of tin plate. Electrochemical data indicate the presence of depolarizers in prunes, but not in grapefruit juice, a fact that explains the different corrosion mechanisms in the various food products.

IN MEMORIAM

The untimely death of Dr. Harry Spector, chief, Nutrition Branch, Quartermaster Food and Container Institute, on August 13, 1959 came as a shock to his many friends in the scientific community.

Dr. Spector directed the research program pertaining to the attainment of nutritional adequacy of operational rations for the Armed Forces. Prior to joining the QMFCIAF staff in 1948, he was associate professor in Animal Nutrition at the University of Illinois. While at the Institute he conducted the symposia, "Nutrition Under Climatic Stress" and "Methods for Evaluation of Nutrition Adequacy and Status," sponsored by the QMFCIAF in cooperation with the National Academy of Sciences—National Research Council.

Dr. Harry Spector

Harry Spector received a bachelor's degree in chemistry in 1937 from the University of Connecticut; a master's degree in nutrition in 1939 from the University of Arizona, where he was a Purnell Fellow; and a doctor's degree in biochemistry in 1944 from the University of Wisconsin.

Dr. Spector served as chairman of the 1957 Gordon Research Conference on Food and Nutrition. The Conferences are affiliated with the American Association for the Advancement of Science, of which he was a member. Other technical societies of which he was a member include: American Institute of Nutrition, American Chemical Society, Association of Vitamin Chemists, Institute of Food Technologists, Society of Experimental Biologists, Phi Kappa Phi, and Sigma Xi. He was certified as *Specialist in Human Nutrition* by the American Board of Nutrition in 1951.

Dr. Spector was born in Bialystok, Poland, in 1915. He is survived by the widow and three children.

Carle C. Conway of 1 Sutton Place South, New York City, for 45 years a leading figure in the development of the American packaging industry and for 24 years successively president and chairman of the board of Continental

(Continued on page 56)

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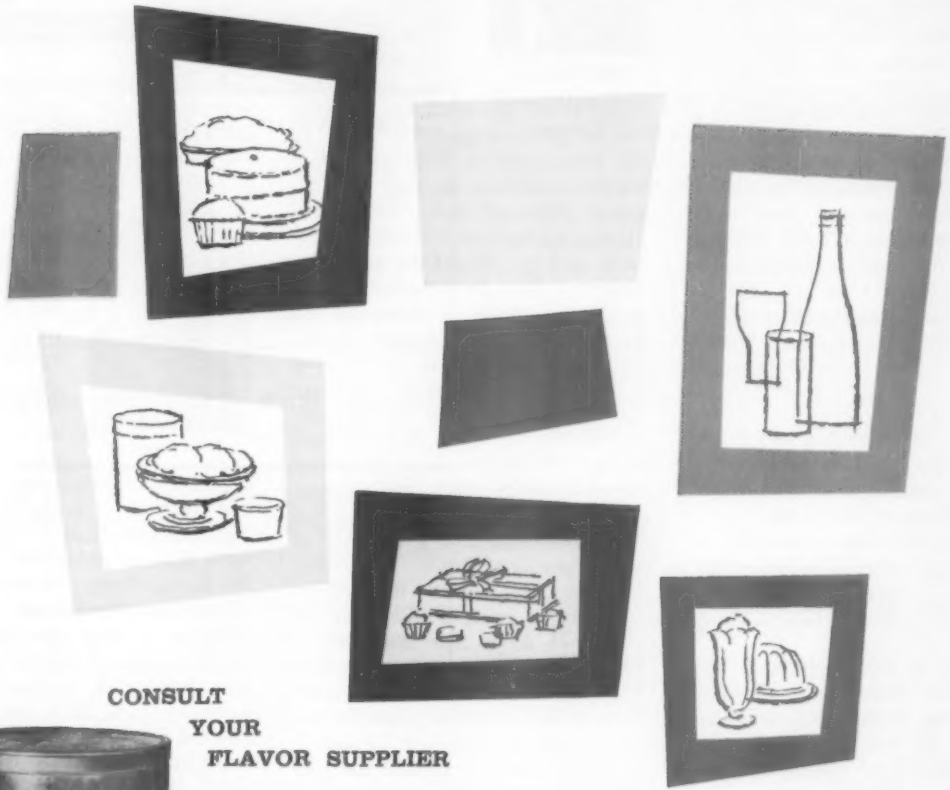

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(Continued from page 54)

C. C. Conway

Can Company, died on August 18th in Lake Placid, N. Y., at the age of 81. A native of Oak Park, Illinois, Mr. Conway was graduated from Yale University in 1899. He entered the piano business early in the century, organizing the Conway Company. He was elected a vice president and director of Continental Can Company at the time of its incorporation in 1913. At that time Continental had annual sales of less than $7 million. In 1950, when he retired as chairman of the board, Continental's sales had increased to $398 million. Mr. Conway was for many years a prominent figure in American financial and industrial circles. He was a principal founder of the Can Manufacturers' Institute and sponsored a number of important research activities by that organization and the National Canners Association. He served as chairman of the Committee for the Study and Reorganization of the New York Stock Exchange, commonly referred to as the Conway Committee, in 1937 and later, in 1939 and 1940, served two terms on the board of governors of the Exchange. He also served several years as a director of the Federal Reserve Bank of New York.

Mr. Conway was intensely interested in helping young people and was an active supporter and a trustee of the Boys Clubs of America, Inc.

In 1950 he established the Carle C. Conway Scholarship Foundation, which in the years since has awarded 46 scholarships to sons and daughters of Continental employees.

General Lucius Clay, who succeeded him as chairman of the board of Continental, said in a statement: "More than any one man, Mr. Conway was responsible for the development of the Continental Can Company into the great packaging corporation which it is today. His vision and enthusiasm were the essential factors in setting the pattern of our growth and his outstanding qualities of leadership were an inspiration to our people. A wise counsellor and a warm friend, his passing will be mourned by all who knew him."

The untimely death of Tom Brinegar in Chicago, August 12, 1959, came as sorrowful news to his wide circle of friends and his associates in the food and feed industries. Interested in agriculture and food and feed research from the time of his entrance into the University of Nebraska, Lincoln, until his death at the age of 44, his versatile career included graduate study at the University of Nebraska, from which institution he held two degrees, B.S. and M.S., and at the Harvard Graduate School of Business and the Stanford Graduate Business School; college teaching at the University of Nebraska and as special lecturer at both Northwestern and DePaul Universities in the Chicago area; military service as an officer in the Quartermaster Corps, World War II, and, in the post-war years, as editor and director of research publications. At the time of his death he was Vice President and a Director of the American Trade Publishing Company, his specific area of responsibility being Publication Director of *Feed Age* magazine, a business and technical journal of wide influence in the industry. Tom Brinegar participated in major degree in launching Volume I, No. 1 of that journal and was continuously thereafter identified with its plans and policies. His knowledge of marketing principles brought him into contact with feed manufacturers throughout the nation, and his vital interest in animal nutrition kept him in touch with the research groups of the universities and associations.

Tom Brinegar

The mark of this distinguished man was manifested in tributes and expressions of sympathy that came from his former associates at the Quartermaster Research and Development Laboratory (World War II predecessor of the Quartermaster Food and Container Institute for the Armed Forces), from business associates in Chicago and New York, from food and agriculture scientists in Government and academic organizations, and friends in all walks of life.

Survivors include his widow Ann, daughter Kathleen Ann, and son Thomas Patrick. Funeral rites were conducted on August 17, 1959, at Queen of All Saints Church, Chicago.

PERSONNEL

A. Paul Bowman, 121 N. Prospect Street, has been promoted to manager of the Oscar Mayer & Co. Madison plant, and two other promotions have been announced to fill vacanies left by the appointment. P. Goff Beach, vice president of operations, in making the announcement, said the company's growth has necessitated a separation of the two positions of general operations manager and Madison plant manager, both of which have been held by R. L. Terry. Terry was appointed to the general operations position a year ago. Eugene T. Meskill, 1642 Mayfield Lane, general industrial engineer for the company since 1956, was named to succeed Bowman as Madison operations manager. Walter S. Brager, 5500 Monona Pass, will become general industrial engineer for the company. Brager's former position as Madison plant industrial engineer has not yet been filled.

A. P. Bowman

Dr. Faith Fenton, New York State College of Home Economics, Cornell University, Ithaca, New

Attention cereal makers:

Here's how Tora Food® can give you a new sales-building nutrition story at low cost

If you need a powerful new story to spark the sales of your cereal, Tora Food (Red Star's brand name for Torula Yeast U.S.P.) is your answer. And you can actually *save* money. Here's what we mean:

How will Tora Food improve nutritional content of cereal? Here are some specific nutritional factors housewives know and look for in cereal. This chart shows you how Red Star Tora Food increases these factors in a typical cereal—corn meal.

PER 100 GRAMS OF CORN MEAL

	Corn meal as is	Corn meal plus 3% Tora Food
Protein	9.00 grams	10.50 grams
Vitamin B_1	0.30 milligram	0.66 milligram
Vitamin B_2	0.08 milligram	0.20 milligram
Niacin	1.90 milligrams	2.80 milligrams

What totally will Tora Food add to cereal?
(At a level of 3# to 100#)

Vitamin B_1	163.5 milligrams worth
Vitamin B_2	54.5 milligrams worth
Niacin	408.6 milligrams worth
Vitamin B_6	40.8 milligrams worth
Para-amino benzoic Acid	20.4 milligrams worth
Pantothenic Acid	150.0 milligrams worth
Folic Acid	95.3 milligrams worth
Choline	4.8 grams worth
Inositol	5.4 grams worth
High quality Protein	1.5 lbs.

Here is a nutritional "barrage" that can't help but impress the nutrition-conscious housewife.

How can Tora Food actually save you money? The ingredients listed above would cost you 87.33¢ at current price levels, if you bought them individually. You get these *same* ingredients in the *same* amounts for only 54¢ in Red Star Tora Food. That's 33.33¢ saved. (Incidentally, the same amount of brewer's yeast would cost you between 72¢ and 84¢.)

In addition, Tora Food saves you money on handling and inventories. Instead of buying, storing, handling and keeping books on 10 or more different ingredients, you need handle only *one* when you use Red Star Tora Food.

How else will Tora Food improve saleability of cereal? Tora Food will intensify the flavor of your cereal. It has a mild, pleasant flavor with the ability to enhance the natural flavor of the product to which it is added.

Furthermore, Tora Food is an antioxidant and helps give your cereal longer shelf life.

Who besides cereal makers can use Tora Food? Almost any food processor. Here we've talked specifically about cereal makers, but baby food processors are already using Red Star Tora Food successfully. And here are some other types of processors who can use Tora Food to big advantage: spice, soup, chocolate, peanut butter, sauce and gravy, health food, smoked yeast and pharmaceuticals.

If you are a cereal maker (or *any* food processor) who wants a new sales-boosting nutrition story, write to us. We'll be happy to show and discuss with you work and analysis that has been done. Or if you prefer, we'll be happy to have a nutritionist call on you. Write to the address below.

Nutritional Division

RED STAR YEAST & PRODUCTS CO.

Milwaukee 1, Wisconsin

York, has retired after many years of distinguished service. In closing her office Dr. Fenton decided to dispose of her complete sets of FOOD RESEARCH (1936–60) and FOOD TECHNOLOGY (including *Proceedings of IFT*) 1940 to date. Libraries or individuals who are interested should correspond directly with Dr. Fenton at the above address with regard to price and other information that may be wanted.

The appointment of **Richard W. Stromberg** to its Special Soya Products Chemurgy Sales organization in Chicago, Ill., has been announced by the Central Soya Company, Inc., Fort Wayne, Ind. In his new position, Stromberg will work primarily with processors of foods and will handle sales of edible soy protein and other special products. Stromberg previously was employed by the White Cap Company, a subsidiary of Continental Can Company, Inc., where he was Chief Food Chemist for 12 years. He is a graduate of St. Norbert College, West Depere, Wisconsin and did graduate work at the University of Wisconsin. Stromberg is a member of the Institute of Food Technology and the American Chemical Society.

R. W. Stromberg

Scudder Food Products, Inc. welcomes to its staff as Technical Director **George Rosenblatt** who for the past twelve years has been associated with the Best Foods Division of Corn Products Company. Initially Mr. Rosenblatt served as Analytical and Development Chemist, assuming the position of Chief Chemist for their Western Division in 1956. A graduate with degree S.B. in Food Technology from Massachusetts Institute of Technology, Mr. Rosenblatt has continued his studies in the chemistry of food production while on the West Coast, at the University of California.

In line with the further expansion of its research activities, and the establishment of a new Research and Development Division, Vacu-dry Company has made two major changes in its research staff. **William R. Dorsey,** formerly Director of Research, has been named a vice president of the company in charge of the newly established Research and Development Division. **Sumner I. Strashun,** formerly Chief Chemist, has been appointed Research Director to fill the vacancy created by Dorsey's promotion. The new appointments were announced by W. E. G. Gallwey, Vacu-dry president. Both Dorsey and Strashun are among

W. R. Dorsey

S. I. Strashun

the nation's foremost food technologists. Both are members of the Institute of Food Technologists and the American Chemical Society. Dorsey is a member of the Advisory Committee to the U. S. Army Quartermaster Corps on Fruit Dehydration. Both men have played a leading part in the technical development and progress of food dehydration. Before becoming associated with Vacu-dry, Strashun served as a research chemist with the U.S.D.A. Western Regional Research Laboratory at Albany, California. According to Mr. Gallwey, the appointment of the two men to their new positions, is in line with the continuing importance of research in Vacu-dry's affairs, and the expansion of its research activities to keep pace with the rapid technical development of the food industries.

Government chemists celebrate 75th anniversary. Seventy-five years of service to the American consumer was celebrated at the annual meeting of the Association of Official Agricultural Chemists held this month at the Shoreham Hotel, Washington, D.C.

The A.O.A.C. was founded in 1884 to establish reliable methods of analysis required for proper enforcement of fertilizer laws. This is still one of the most important phases of the A.O.A.C.'s work. As other laws were passed for consumer protection, the A.O.A.C. provided methods of analysis without which enforcement of pure food and drug laws, and laws regulating the sale of other agricultural commodities such as feeds and pesticides, would be much more difficult —if not impossible. More recently, its sessions have been concerned with methods of analysis for determining minute pesticide residues on foods as well as methods for food additives which are necessary under the latest amendments to the Federal Food, Drug, and Cosmetic Act.

At the annual meetings of the A.O.A.C. the professional scientific workers in Federal and State agencies who are concerned with enforcing laws and regulations that deal with agricultural commodities meet with scientists from the regulated industries.

The Anniversary meeting was honored by the presence of several nationally known speakers: Professor Joel H. Hildebrand, formerly professor at the University of California, addressed the Association on "The Battle for Basic Education," and R. C. Newton, formerly Research Director of Swift & Company, spoke on "Industry Benefits from Standard Methods of Analysis." "Frozen Foods" was the topic of the annual address of the President of the A.O.A.C., Dr. A. H. Robertson, State Chemist of the State of New York. "Pesticide Residues in Foodstuffs: Analytical Philosophy, Technology, and Capabilities in Europe" was the title of an address by Francis A. Gunther, winner of the 1959 Harvey W. Wiley Award of the A.O.A.C. Dr. Gunther, who has just completed a visit

to Europe to review the field of his specialty, received his award at the annual banquet of the Association held the evening of October 12.

Edmond Opler, president of Cook Chocolate Company, Chicago, has announced the appointment of M. O. Ricker as director of Research and Quality Control. Mr. Ricker was formerly associated with Walter Baker Chocolate Division of General Foods.

MEMORANDA

Work is now under way to determine what types of earth bacteria and vegetation could exist on the planet Mars. The studies are being made by scientists at Armour Research Foundation of Illinois Institute of Technology. Conditions on Mars are distinctly different from those here on earth. For example, on the average Martian summer day, the temperature may soar to a high of 77° F. and drop to 18–22° below zero F. at night. The Martian atmosphere consists mainly of nitrogen (about 98.5%) with the bulk of the remainder being made up of argon. Carbon dioxide and oxygen make up an insignificant percentage. The atmospheric pressure on Mars is about 1.257 prounds per square inch or roughly one eleventh of that here on earth. In the ARF study, a Martian atmosphere is being simulated in test tubes. Into these tiny atmospheres have been placed three known species of earth bacteria and two forms of basic vegetation.

The bacteria — *Klebsiella pneumonia* (cause of one form of pneumonia), *Clostridium botulinum* (acute food poisoning), and *Clostridium tetani* (cause of tetanus) — are relatively resistant to high temperatures and relatively unaffected by atmospheric pressure. In the case of the two Clostridium bacteria, they can live in the absence of oxygen. Of particular interest to the ARF scientists is whether the bacteria can survive in the Martian atmosphere and, if they do survive, whether they can maintain their virulence.

The basic forms of vegetation selected were mosses and lichens because their characteristics seem to fit the conditions as they are thought to be on Mars. Lichens are composed of fungus and algae. Both the fungus and algae are dependent on each other. The fungi are often found on rocks and provide water-soluble minerals to the algae portion which is capable of sustaining itself by photosynthesis —the same process trees and other higher forms of plants utilize to promote life and growth. Lichens are particularly sturdy. Certain species are found far north in the arctic regions as well as in arid desert regions or on the slopes of active volcanoes.

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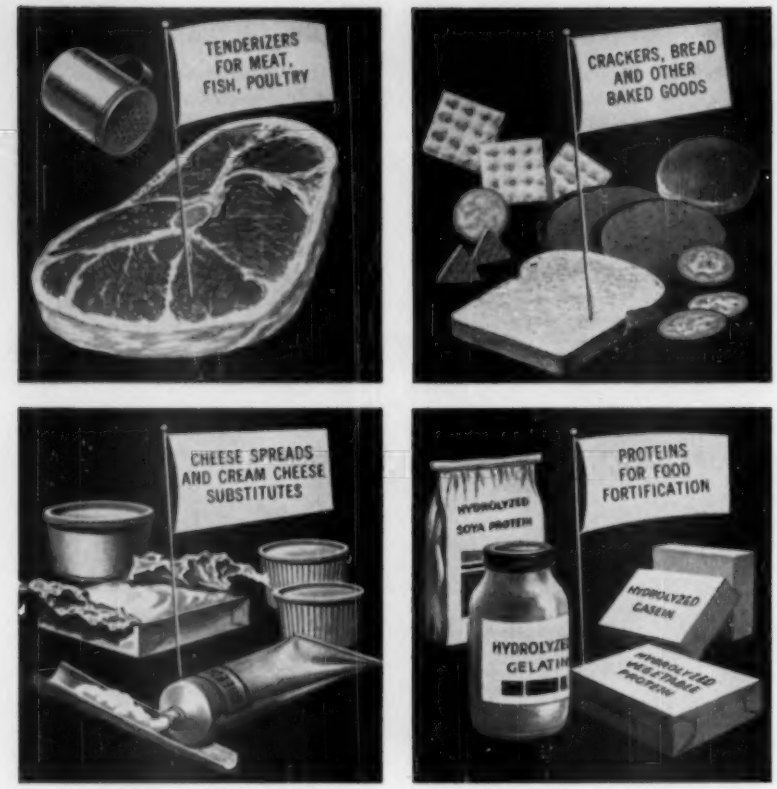
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RHOZYME proteolytic enzymes promote the hydrolysis of proteins to polypeptides and amino acids. This action can be used to: 1) make meat tender but not mushy, 2) produce tender, evenly-browned crackers with no curls or blisters, 3) impart uniform grain and texture to bread and other baked goods, 4) make cheese spreads and cream-cheese substitutes from whey and economical vegetable raw materials, 5) produce food-fortifying protein hydrolyzates—hydrolyzed casein, gelatin, soya protein, vegetable and animal protein—for products such as diet foods, soups, cereals, pharmaceuticals, animal feeds, and many others.

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In the case of the vegetation, the nature of the ARF study will be a bit different. First is the question of whether the surviving forms would have any nutritive value for man, in other words, a food source. Supplying any expedition to Mars will certainly have its problems. Existence of a food source on the planet could very well be the difference between success and failure of an exploratory visit. The study is being conducted by Ervin Hawrylewicz under the supervision of Dr. Richard Ehrlich.

Chemistry in Action (Truesdail Laboratories, Inc., Los Angeles, Calif.) in an editorial, "A Threat to Free Enterprise," states that one of the most serious threats against the independent laboratory profession today stems from the unfair competition by the non-profit tax-exempt research institutes and by some educational institutions. These non-profit operations were created with noble purposes, in some cases, under tax-free charters. In most instances, it was planned they would carry out basic research for the good of the public or they would develop new processes and products with such research results freely available to all. Thus, they were granted Federal tax exemption, as well as State, County and Municipal tax exemptions in some cases. Almost without exception, they went into the business of applied research, testing, and analysis, with little attention to their original purpose. The American Council of Independent Laboratories will continue to challenge the status of any tax-favored group which poses as serving the public without providing access to findings by qualified persons, except those involving national security. There is evidence that professional groups such as the consultants and marketing research people, who face similar unfair competition, will join this fray.

International Conference Held

An International Conference on the Preservation of Foods by Ionizing Radiations was held at the Massachusetts Institute of Technology on July 27–30, 1959, inclusive.

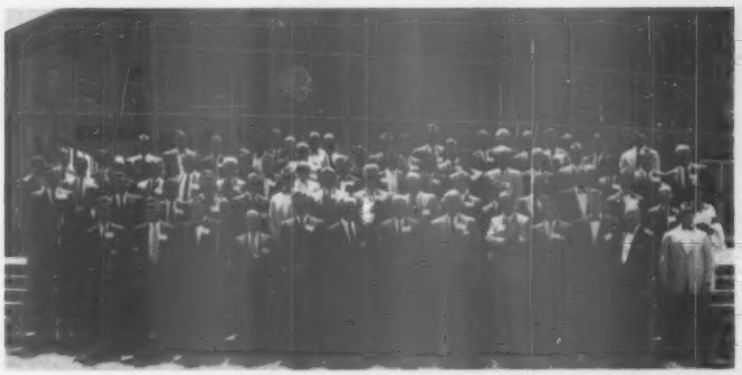
This Conference, sponsored jointly by the Department of Food Technology at M. I. T., the U. S. Atomic Energy Commission, and the International Atomic Energy Agency, was attended by 30 representatives of 27 foreign countries.

The program was chaired by Professor Bernard E. Proctor, Head of the Department of Food Technology.

At the dinner meeting the first evening, the group was addressed by Dr. Henry Seligman, Deputy Director General of the International Atomic Energy Agency.

The following scientists were present from foreign lands:

Dr. Antonio Bacigalupo, Peru
Dr. Wladyslaw Bednarczyk, Poland
Dr. Maurice Bernaerts, Belgium
Dr. Howard Boroughs, Costa Rica
Dr. Pradisth Cheosakul, Thailand
Prof. Borisas Cimbleris, Brazil
Dr. Ruben Dardano, El Salvador



Participants and attendees at the International Conference on the Preservation of Foods by Ionizing Radiations, Massachusetts Institute of Technology, Cambridge, July 27–30, 1959.

Mr. Mario P. de Figueiredo, Portugal
Dr. DeZeeuw, The Netherlands
Dr. Lars-Eric Ericson, Sweden
Mr. Gudlaugur Hannesson, Iceland
Mr. J. R. Hickman, England
Mr. H. R. Hinton, England
Prof. J. M. Kuprianoff, Germany
Mr. K. F. MacQueen, Canada
Dr. W. R. McMurray, South Africa
Mr. G. Mocquot, France
Mr. Michael J. Mulcahy, Ireland (M.I.T.)
Dr. K. K. Nair, India
Mr. Manzoor E. Raja, Pakistan
Mr. Hans Riemann, Denmark
Dr. Dyson Rose, Canada
Mr. G. D. Sarvacos, Greece
Dr. Henry Seligman, Austria
Dr. Santos Soriano, Argentina
Mr. Kjell Steenberg, Norway
Prof. Yusuke Sumiki, Japan
Dr. Zeki Tolgay, Turkey
Mr. Roberto Trevino, Mexico
Mr. Truels A. Truelsen, Denmark

A number of observers from the United States were present also.

The foreign delegates presented great interest in radiation preservation of foods as a possible means of helping solve some of the problems in food preservation and food distribution in their respective countries.

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WANTED: FOOD TECHNOLOGISTS, B.S. or advanced degree. Leading Midwest meat processing firm needs creative personnel in Development and Applied Research positions. Offer considerable challenge and opportunity for advancement in newly created areas of food research. REPLY BOX 720, Institute of Food Technologists, 176 W. Adams St., Chicago 3, Ill.

WANTED: FLAVOR-SEASONING CHEMIST. Food Research Department of national meat processing company located in Midwest has need of flavor and seasoning chemist in Applied Research and Product Development. Should have good academic background and at least 3 yrs. exp. in seasoning formulations. Salary open. REPLY BOX 721, Institute of Food Technologists, 176 W. Adams St., Chicago 3, Ill.

CHEMIST/FOOD TECHNOLOGIST—wanted to take charge of research and development program on new processed and frozen foods for progressive, medium sized company in Middle Atlantic States. Previous experience and sound business judgment essential. Advise references, experience, and starting salary range desired. REPLY BOX 722, Institute of Food Technologists, 176 W. Adams St., Chicago 3, Ill.

AVAILABLE—FOOD TECHNOLOGIST. 20 yrs. experience. Excellent applied research and new product development background. Extensive market planning and customer contact in food and related fields. Will relocate. REPLY BOX 723, Institute of Food Technologists, 176 W. Adams St., Chicago 3, Ill.

FOOD TECHNOLOGIST wanted. B.S. or M.S. degree. Under 35. For employment in large food processing plant. Technical area diversified. Research and Development, Quality Control, general training program in plant operations. Medium size Indiana city. Send photo, resumé and salary requirement. REPLY BOX 717, Institute of Food Technologists, 176 W. Adams St., Chicago 3, Ill.

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PRODUCT DEVELOPMENT CHEMIST
to do product development research in
NEW RESEARCH LABORATORIES

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WANTED: Chemist and Food Technologist to head Research and Development Department of wheat flour mill with plans to expand in other cereal and allied products using as much as possible locally produced materials. Apply giving full details of family, education, academic background, experience and salary desired to BOX 705, Institute of Food Technologists, 176 W. Adams St., Chicago 3, Ill.

FOOD TECHNOLOGIST
24-30
Salary $7,200 to $8,800

Outstanding opportunity for young man in Research Department of young growing food concern. Minimum requirements B.S. in Food Technology. Locate in Houston, Texas. Send resume to Uncle Ben's, Inc., P.O. Box 1752, Houston, Texas.

POSITION WANTED: Tech. Sales/Mkt. Development. B.S., 13 years Sales, Market Development, Market Research and Sales Administration experience. Good knowledge food field plus drug, cosmetic, detergent, chemical specialties and related industries. Interested responsible position utilizing this background. Employed, available reasonable notice. REPLY BOX 694, Institute of Food Technologists, 176 W. Adams St., Chicago 3, Ill.

FOOD TECHNOLOGIST—A leading citrus product manufacturer in Florida seeks a Food Technologist for the Research & Development Division. Applicants must have good technical background and creative ability. Submit resumé to BOX 715, Institute of Food Technologists, 176 W. Adams St., Chicago 3, Ill.

POSITION WANTED: FOOD TECHNOLOGIST—B.S. with 7 yrs. extensive and responsible exp. in technical service: Quality and Production Control in diversified food processing. Desires challenging position preferably in Product Development, Technical Service or Quality Control. Metropolitan NYC area or Northern New Jersey. REPLY BOX 716, Institute of Food Technologists, 176 W. Adams St., Chicago 3, Ill.

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WANTED: FOOD TECHNOLOGIST, young man, for control and development work with chocolate and fruit beverages syrups, etc. B.S. degree. No experience necessary. Salary open. Chicago location. REPLY BOX 713, Institute of Food Technologists, 176 W. Adams St., Chicago 3, Ill.

AVAILABLE: Young man to assume top level administrative position. B.S. Chemistry plus advanced business courses towards MBA. Extensive experience inludes Production, Quality Control of vegetable, meat, dairy and chocolate products, and Administration of general laboratory business activities. REPLY BOX 719, Institute of Food Technologists, 176 W. Adams St., Chicago 3, Ill.

AVAILABLE: Flavorist, completing present assignment, seeks position to thoroughly exploit demonstrated ability and unusually complete background in flavor creation and research. Work well with advertising and marketing people. Experience can be used to maximum advantage to guide a team effort in flavor development. REPLY BOX 718, Institute of Food Technologists, 176 W. Adams St., Chicago 3, Ill.

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PLACEMENT IN CANADA sought by Greek Food Chemist, now getting Ph.D. in U.S.A. Strong background in chemistry, biochemistry, radiation chemistry, nutrition, meat and fat research. Seven years experience with industry. Academic or industrial position. Available February 1960. REPLY BOX 714, Institute of Food Technologists, 176 W. Adams St., Chicago 3, Ill.

FOOD TECHNOLOGIST: Leading appliance company located in Chicago is in need of a Food Technologist for its Advance Research Division. Position requires—(1) Ph.D. or equivalent with strong emphasis in Math., Physics, Biology and Chem. (2) Three to five yrs. applied research exp. (3) Current knowledge of food technology as it relates to the appliance industry. REPLY BOX 701, Institute of Food Technologists, 176 W. Adams St., Chicago 3, Ill.

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